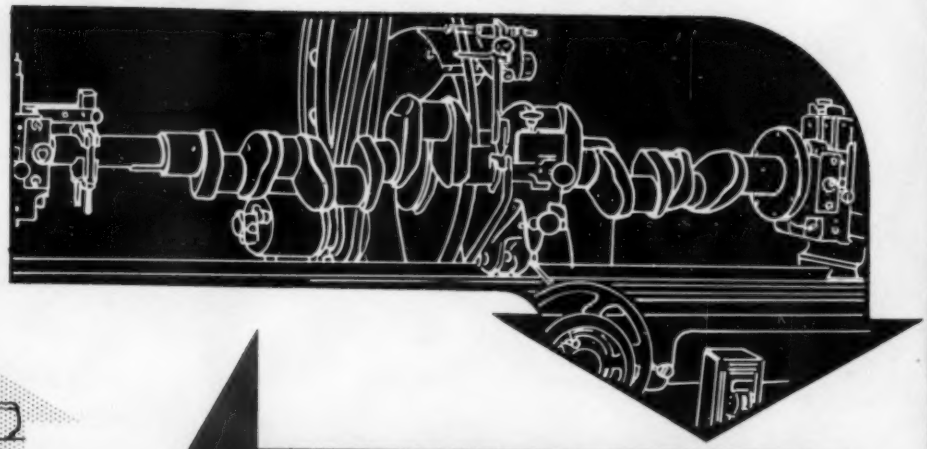
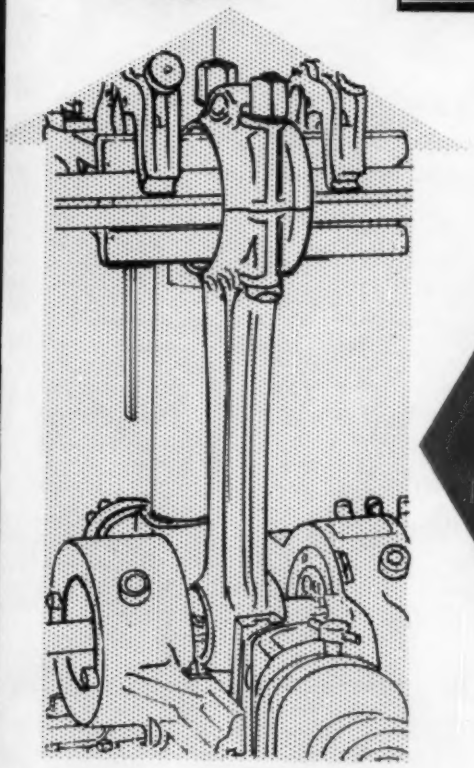
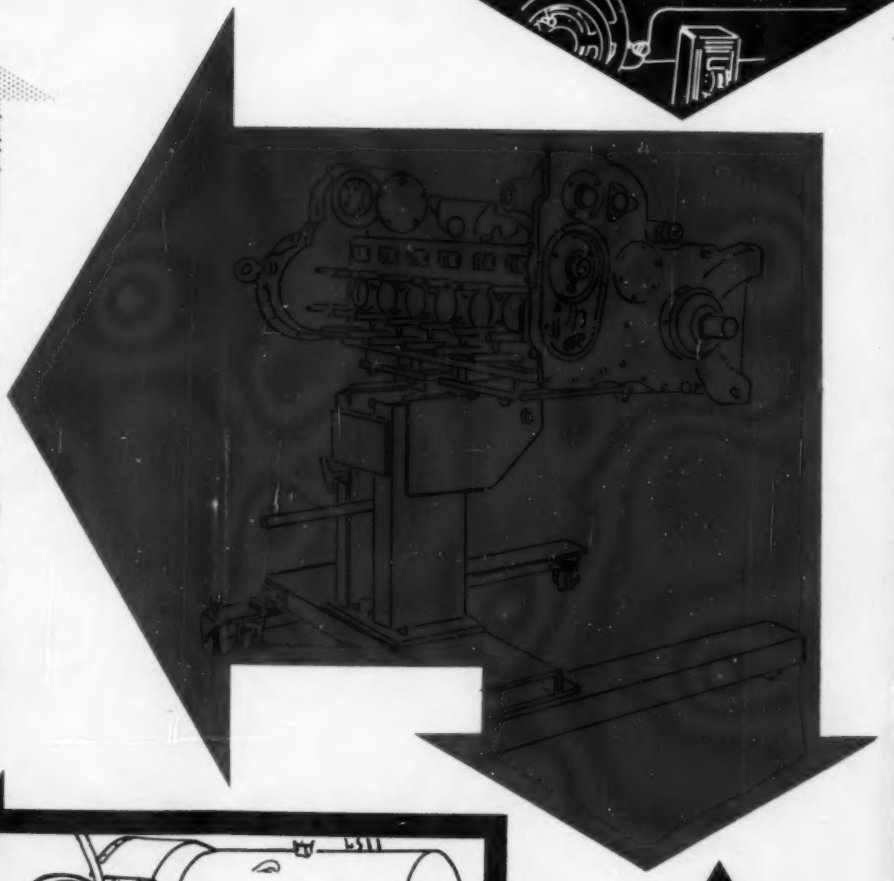
diesel power

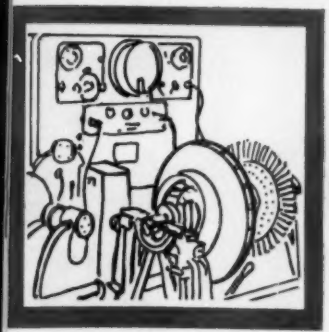
October 1958

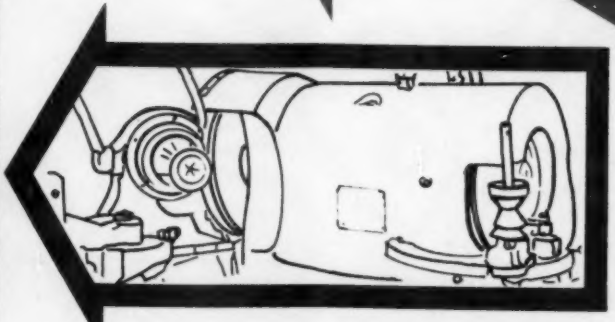
TOOL & MAINTENANCE ISSUE

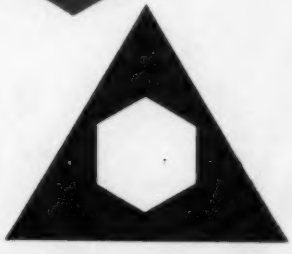








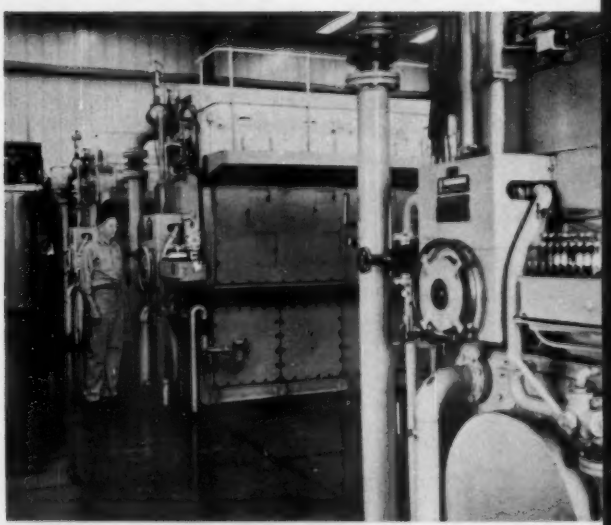




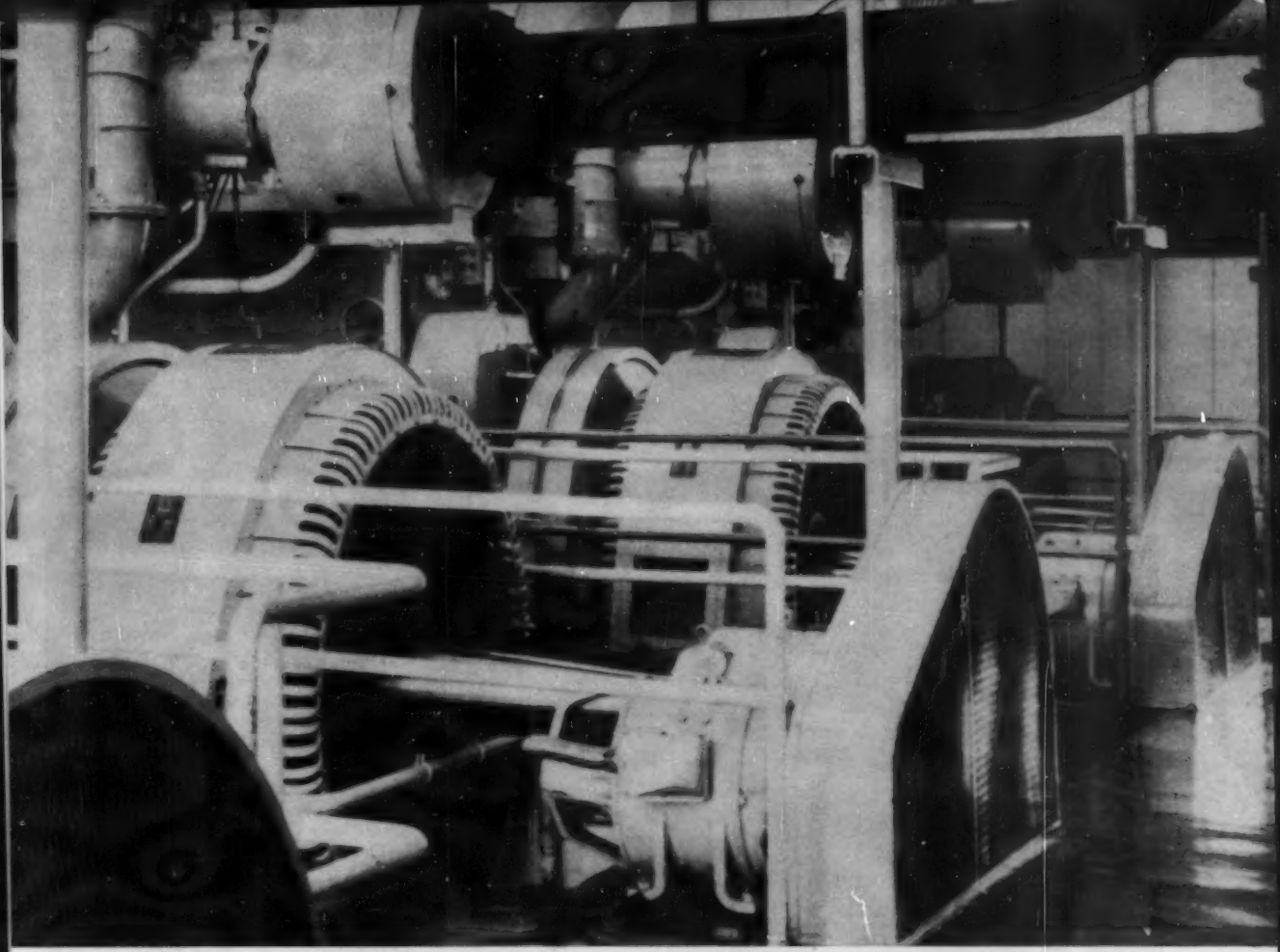
EFFICIENCY AWARD for 1957 (Division A) goes to Federated Rural Electric Assn. for producing power at the low cost of only

"MOST EFFICIENT" REA

A GOOD NEIGHBOR as well as an efficient one, Federated's modern plant is handsomely landscaped, and the engines exhaust into Maxim silencers.



POWERFUL PERFORMERS stay powerful with Texaco Lubrication. Each 8-cylinder 4-cycle Nordberg Duafuel engine is rated at 1750 hp at 327 rpm.



6.54 mills per kwh. Manager Paul L. Ferguson reports that "Lubrication with Texaco Ursa Oil Heavy Duty, and frequent thorough engine checks, have kept average liner wear (all engines, all cylinders) down to 0.005" after 33,000 hours operation."

plant wins title with Texaco

A combination of rigid maintenance standards and the use of Texaco Ursa Oil Heavy Duty has won two *Diesel Progress* awards for efficiency for Federated Rural Electric Association, Jackson, Minn. In 1954, and again for 1957, Federated was named "the most efficiently operated of all REA internal combustion plants." This is how Texaco has helped Federated stay on top:

Texaco Ursa Oil Heavy Duty keeps engines clean, for maximum efficiency. It prevents formation of sludge, keeps the rings free and compression high, so the engine uses less fuel, and runs longer between scheduled overhauls.

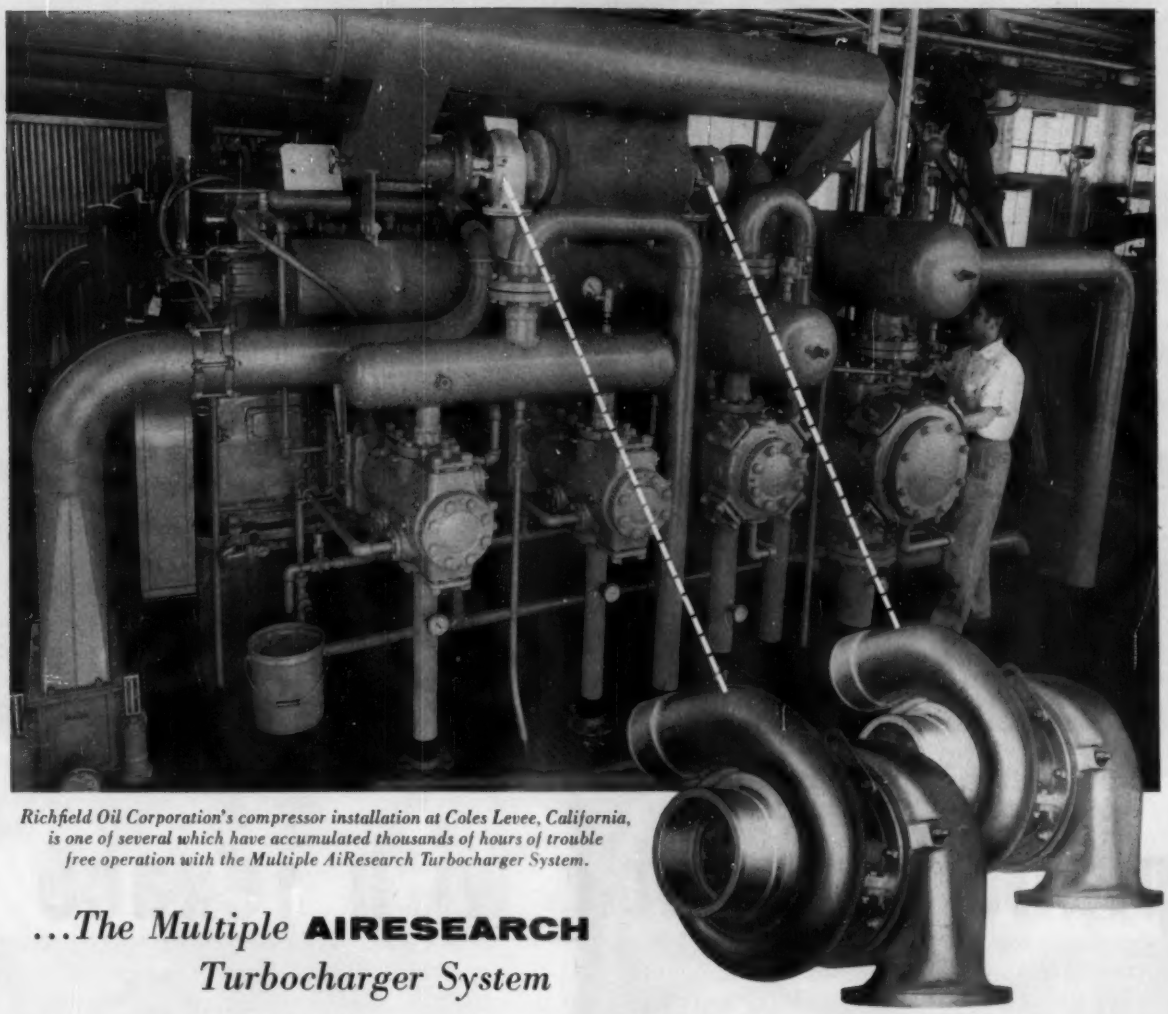
Minimizes wear, too. Texaco Ursa Oil Heavy Duty is a premium quality lubricant, one of the complete line of Texaco Ursa Oils especially refined and processed to lubricate diesel, gas and dual-fuel engines. For details on what Texaco Ursa Oils can do in your plant, call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME MAINTENANCE)

POWER BOOSTING RICHFIELD'S 2-CYCLE GAS COMPRESSORS



Richfield Oil Corporation's compressor installation at Coles Levee, California, is one of several which have accumulated thousands of hours of trouble free operation with the Multiple AiResearch Turbocharger System.

...*The Multiple* **AIRESEARCH** *Turbocharger System*

has helped solve the Richfield Oil Corporation's need for more power to meet increased demands at its compressor stations. Turbocharging the 2-cycle natural gas engines with the Multiple AiResearch Turbocharger System proved to be an economical and quick method for boosting power.

The turbocharger installation is simple and clean. Two production-type AiResearch turbochargers are mounted directly on the exhaust manifold. The compressed air is directed to the engine intake through an AiResearch intercooler. This increases engine output from 300 H.P. to 375 H.P.

AiResearch is a leader in the development and production of air-cooled turbochargers and turbocharger controls for all major diesel engine applications.

Your inquiries are invited.

THE GARRETT CORPORATION

AiResearch Industrial Division

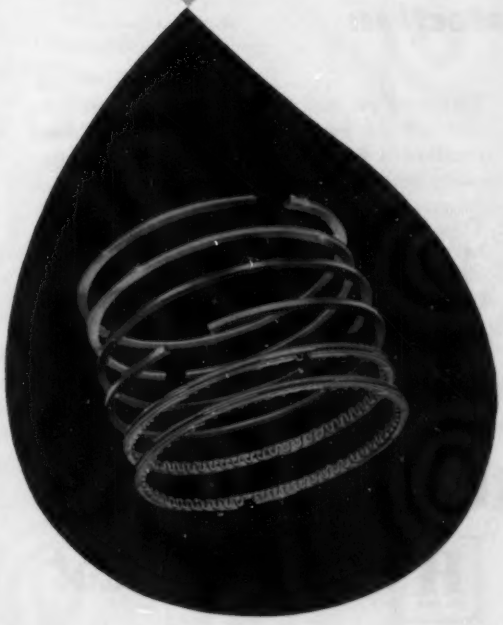
9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

why "Precisioneered"

PEDRICK PISTON RING SETS

Improve Diesel and Gas Engine Performance!



PEDRICK Piston Ring Sets for diesel and gas engines are "precisioneered" to assure maximum power with minimum oil consumption, to most effectively seal against blow-by, to deliver the greatest number of hours of efficient performance at lowest operational and maintenance costs.

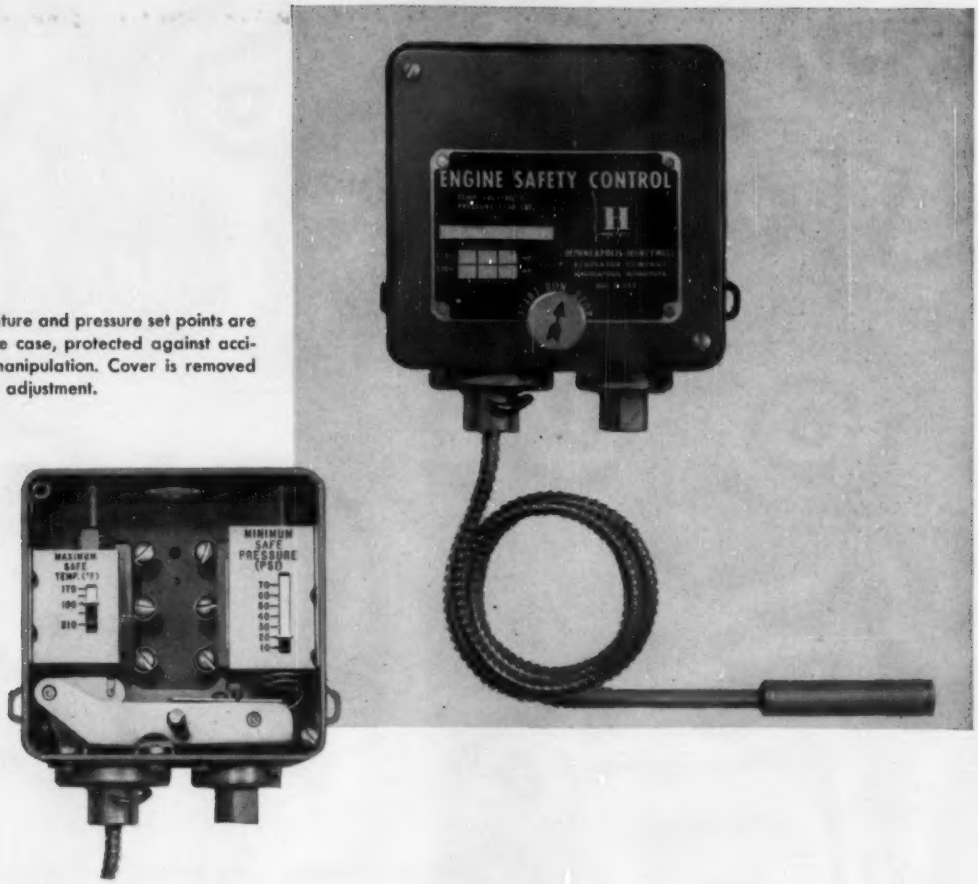
The rings in a PEDRICK "Precisioneered" Set are individually designed to assure users coordinated *team* action. The assembled set is tailor-made for *unitized* action in the specific engine.

That's why PEDRICK Engineered Sets are used as original equipment in practically all leading heavy-duty diesel and gas engines . . . and why when replacement rings are installed, PEDRICK Engineered Sets are specified by most maintenance men.

Complete Sets . . . or open-stock rings, you get improved performance, more economical operation when you specify PEDRICK Piston Rings. And remember, if you have any kind of a ring problem, you can count on us to help you solve it. Write, wire or phone: WILKENING MANUFACTURING COMPANY, Philadelphia 42, Pa. SAratoga 9-3770. In Canada: Wilkening Manufacturing Co. (Canada) Ltd., Toronto 2.

Pedrick PISTON RINGS

PEDRICK PIONEERED Conformable RINGS FOR BIG BORE ENGINES



Temperature and pressure set points are inside the case, protected against accidental manipulation. Cover is removed for easy adjustment.

New Diesel engine safety switch

...gives fail-safe protection

This all-new Honeywell safety switch responds to abnormal pressure or temperature to stop or idle a diesel engine, or actuate an alarm circuit.

It combines separate systems for measuring engine coolant temperature and lubricating oil pressure. The temperature system includes an exclusive fail-safe feature, so that in case of damage to its temperature bulb, capillary or diaphragm, the switch responds as it would to excessive temperature.

Temperature and pressure settings can't drift off set points. There can be no false shutdowns due to vibration. Set points are easily adjustable in the field.

Your nearby Honeywell field engineer will be glad to give you complete information about the new Diesel Engine Safety Switch. Call him today . . . he's near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Specification sheet S1010-5 "Diesel Engine Safety Switch."**

Honeywell

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BPA

diesel power

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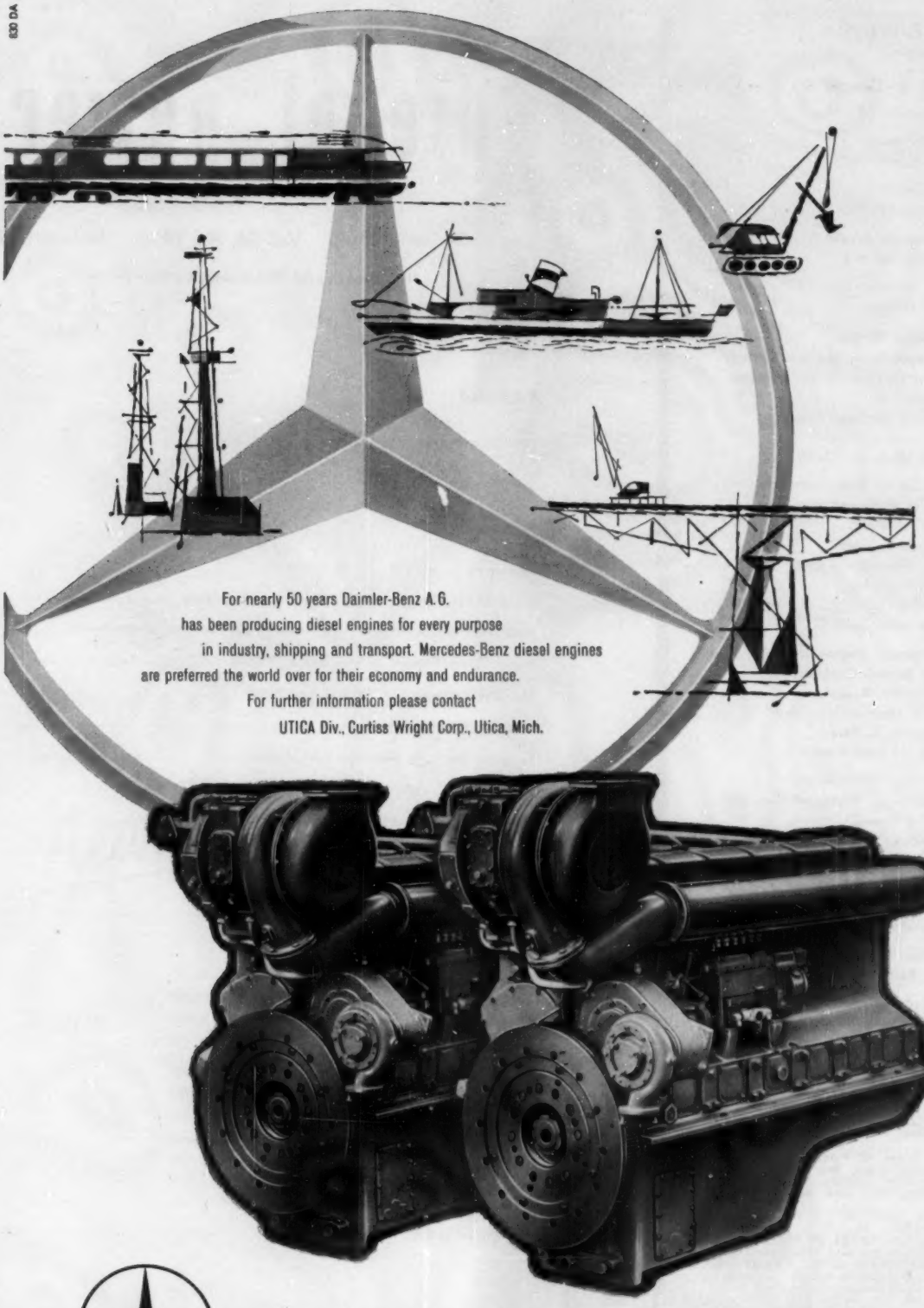

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has been producing diesel engines for every purpose
in industry, shipping and transport. Mercedes-Benz diesel engines
are preferred the world over for their economy and endurance.
For further information please contact
UTICA Div., Curtiss Wright Corp., Utica, Mich.

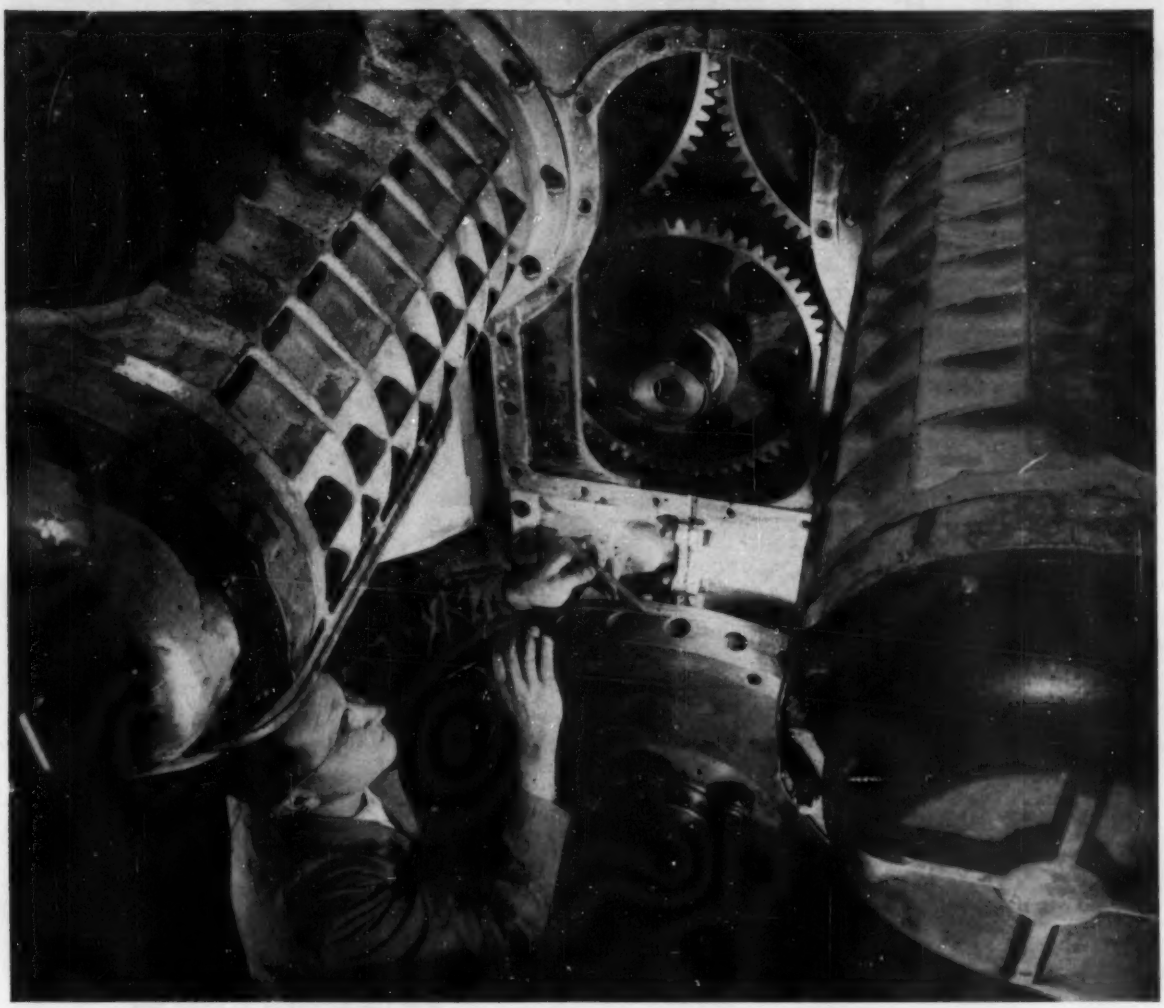
MERCEDES-BENZ

ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL RR

NORTHERN PACIFIC RAILWAY

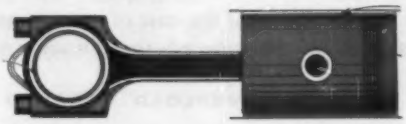
FIRM South Tacoma, Wash.



RR diesel gears show only ½° wear in 2½ million miles

Timing gears on this Northern Pacific GMC-diesel locomotive engine, lubricated with RPM DELO Oil RR, recently completed 2½ million miles of severe freight service without repairs or adjustment. NP's South Tacoma Shop Foreman, A. R. Genin (above), indicates degree marks on engine flywheel, used to gauge gear wear. Tolerance between gear teeth shows variance of just ½° from original setting. Mr. Genin says, "We consider this low rate of wear remarkable for heavy-duty freight operation. It is typical of our experience during the 12 years we have used RPM DELO Oil in all our locomotive diesels." Engines are 1350 h.p. 16-567 series.

Why RPM DELO Oil RR reduces wear, corrosion



• Oil stays on engine parts—hot or cold, running or idle • Anti-oxidant resists lacquer formation • Detergent keeps parts clean • Special compounds prevent corrosion of bearing metals • Inhibitor resists foaming.

For More Information about RPM DELO Oils or other petroleum products of any kind, or the name and address of your nearest distributor, write or call any of the companies listed below.

LUBRICATING OILS RPM DELO

TRADEMARK "RPM DELO" AND DESIGN REG. U. S. PAT. OFF.

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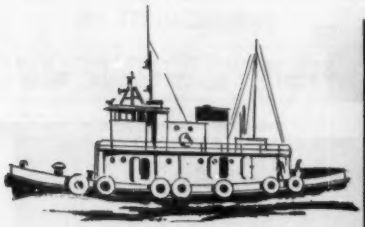
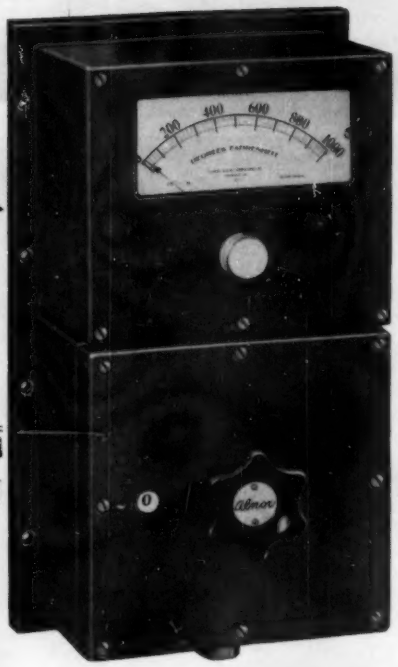
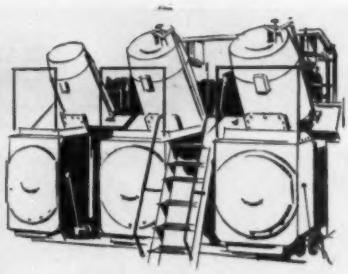
STANDARD OIL COMPANY OF TEXAS, El Paso

THE CALIFORNIA COMPANY, Denver 1, Colorado

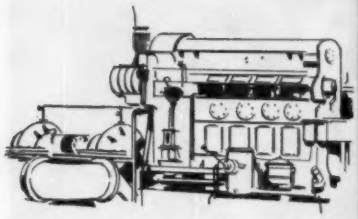


Marine

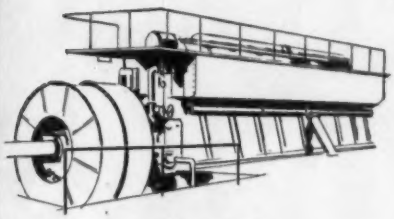




Engine compressor



Pumping



Stationary

GET THE BEST FROM THE POWER YOU BOUGHT...

WITH *Alnor*® PROTECTION

Accurate check of exhaust temperatures with an Alnor Pyrometer system can assure minimum fuel consumption per horsepower and long service from the power you bought—without the interruption of many common-cause breakdowns.

At a fraction of the cost of your present engine maintenance bill, an Alnor system can give you advanced warning of:

CYLINDER OVERLOAD	SCALED JACKETS	DETONATION
PREIGNITION	CLOGGED PORTS	FAULTY INJECTION

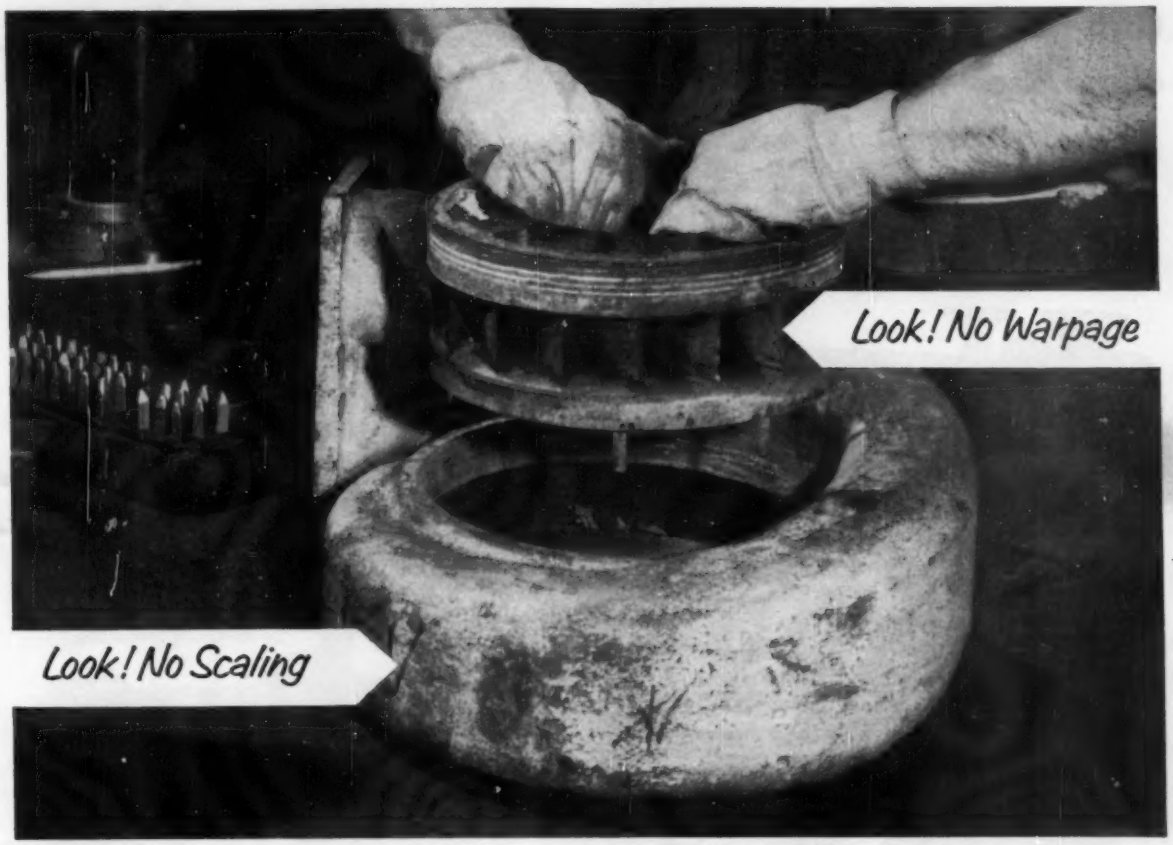
Series A Pyrometers are designed specifically for direct mounting on diesel engines or other equipment subject to vibration and rough usage. Readings are accurate to within + or −1%. Dustproof, fumeproof, splashproof. Switch capacities of 4, 6, 8, 10, 12 and 16 circuits. Other models to 31 circuits. Get full information—by return mail. Send for Bulletin 4361 with complete details of the Pyrometer and thermocouple assembly designed for your engine.

Alnor

write:

ILLINOIS TESTING LABORATORIES, INC.

Room 507, 420 No. LaSalle St., Chicago 10, Illinois



After 21 months service turbocharger parts look good as new

The Ni-Resist* austenitic iron nozzle ring and turbine casting (above) look nearly good as new. And they are! A little cleaning . . . and both go right back on the job again.

Hot parts in turbocharger last longer when made of Ni-Resist

Stands to reason! Ni-Resist cast iron resists growth 12 times better than plain iron, resists scaling 10 times better. It holds dimensions – no warping or cracking – after months of service.

Another advantage! Type 2 Ni-Resist's coefficient of expansion closely matches that of the 302 stainless steel Elliott Company uses for nozzle blades. So blades don't crack . . . stay firmly seated during heating and cooling cycles.

Other ways Ni-Resist can help you

The same properties that made Ni-Resist cast iron valuable in turbochargers can be used to solve heat, corrosion, wear and galling problems in ring carriers, manifolds, for example. In Inco's new folder, "The Cast Material that makes Turbochargers Practical," you get a quick, easy-to-read summary of Ni-Resist's proven advantages in turbocharger equipment. To get your copy, fill out the coupon below.

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NI-RESIST

NICKEL ALLOYS PERFORM BETTER LONGER

Unique packing retention method eliminates test rings

simplifies inspection and servicing reduces maintenance time

Paracoil

TYPE "PC" EXCHANGER

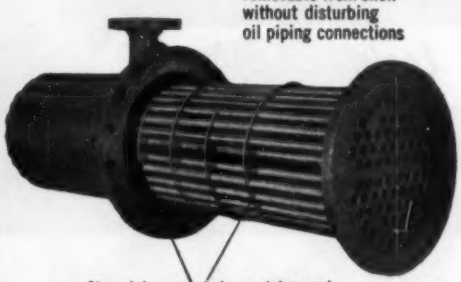
Straight-tube exchanger for oil, water, air or gas

Exclusive "retainer ring" design, available only in Paracoil "PC" Exchangers, **permits shell side pressure test with bonnet removed. No auxiliary equipment or special devices are required to hold tube sheet packing against pressure.** By backing off only one set of nuts, bonnet may be removed without displacing packing or retainer ring. Pressure may be applied to shell side to test for defective tubes or leaking tube joints. With bonnet off, retention studs hold retainer ring and packing in place.

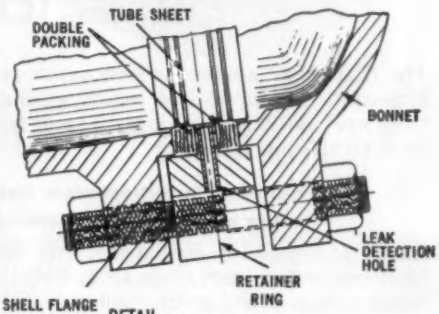
Leak detection holes in retainer ring show leakage from either tube or shell sides (See detail below).

Tubes may be tested, re-rolled, even replaced, without removing tube bundle from shell.

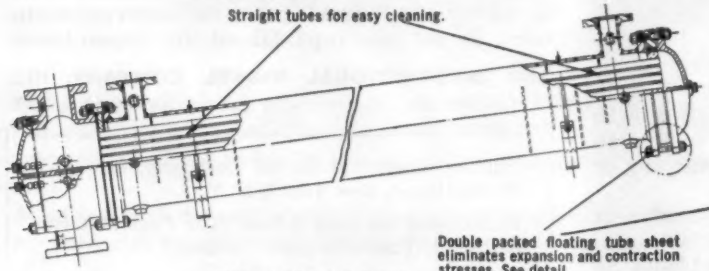
Tube bundle easily removable from shell without disturbing oil piping connections



Close tolerances between tubes and tube holes in baffles, and between baffle periphery and shell, assure maximum heat transfer.



DETAIL — Section thru floating tube sheet showing packing and detection hole in retainer ring.



Straight tubes for easy cleaning.

Double packed floating tube sheet eliminates expansion and contraction stresses. See detail.

Wide selection of materials as dictated by service requirements.

Standard commercial, ASME or Marine Code construction.

HOW IT WORKS

Mixing of shell and tube side fluids due to packing failure is impossible in this Paracoil Type "PC" design. Any leakage from either side, resulting from loosening of bolts or worn packing, escapes through the detection holes. The operating personnel is thus on notice that servicing is required.

Paracoil
HEAT TRANSFER EQUIPMENT

Write for descriptive Bulletin 140

Since 1915

DAVIS ENGINEERING CORPORATION

30 Rockefeller Plaza, New York 20, New York

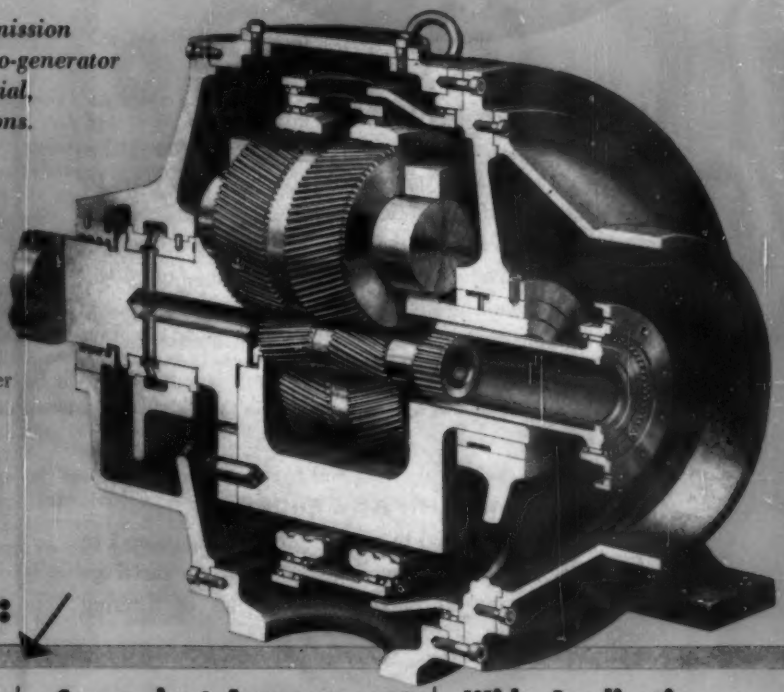
DE LAVAL-STOECKICHT
PLANETARY GEAR

...for high speeds...high horsepower

Proved in hundreds of installations abroad totalling over 3,000,000 horsepower—now available in America!

For all high torque power transmission applications such as pump turbo-generator and compressor drives in industrial, municipal and marine installations.

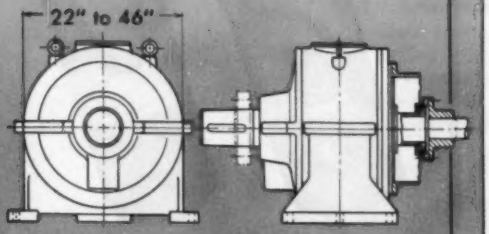
This cutaway view of the De Laval-Stoeckicht Planetary Gear shows how it provides flexibility for proper load distribution throughout the gear members. The thoroughly proved and tested design is completely reliable in transmitting high horsepower for high speed applications. • Highest efficiencies (98% or higher)... no high speed bearings... less friction losses.



Check These Advantages:

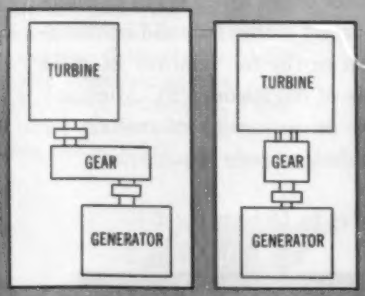
Small Size—Light Weight

Compact—low weight per hp. Sizes range from 22" to 46" in diameter, depending on horsepower requirements. Example: 5000 hp planetary unit weighs 1700 lbs. against 6000 lbs. for conventional gear.



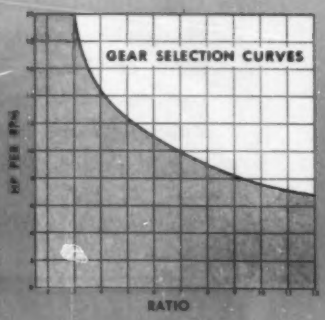
Convenient Arrangement

Co-axial or "in-line" arrangement of gear members takes up far less space than parallel axis gears of equivalent horsepower rating.



Wide Application

Capacity range shown in shaded area on chart below. For other applications, contact your De Laval Sales Engineer.



For further details, write for Bulletin 2400.

DE LAVAL *Steam Turbine Company*

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Fulflo FILTERS REG U S PAT OFF

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Fulflo Filters with genuine Honeycomb Filter Tubes provide true depth filtration at high or low flow rates for stationary engines, mobile engines or bulk fluids. Every drop is filtered finer and finer — through hundreds of precision controlled filtering tunnels. These diamond-shaped tunnels are engineered for exact uniformity in size, shape, depth and density. Contaminants are securely trapped in inner storage cells.

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Editorially speaking -

On Maintenance Engineering

Throw the average design engineer into a maintenance shop and he'd be lost. Ask him to pinpoint the causes for an obscure but bothersome engine condition. Or decide whether the lube oil changeout period can be safely increased. Chances are that he'll be stumped. Normal scope of his engineering activity does not provide the background and experience for making decisions in this type of engineering. And a high level of engineering, both theoretical and practical, is needed to cope with problems of this sort that are cropping up daily in the field of maintenance engineering. This is particularly true with today's high-performance engines that require a highly exacting brand of operation and maintenance. In all fairness, the maintenance engineer would be equally confused if handed the design engineer's project. We're not being critical; we're just pointing out that these are two separate phases of engineering even though the same equipment is involved. Each phase has its own objective, its own background and wealth of specialized know-how, and even its own philosophy. The design engineer is concerned in building the best product that he can at a price the market can afford. The maintenance engineer takes this product, adapts it to do a specific job and then tries to operate it efficiently at the lowest cost for the maximum length of time. The jobs are equally important and require equal though different skills. Yet while the status of the design engineer is clearly defined, the maintenance engineer commands less recognition. He's growing in stature, though. Management is learning the economic importance of high-grade maintenance engineering. Railroads learned this early and we find top-flight engineers heading up maintenance. And we're glad to see a steady improvement in the caliber of men in top maintenance spots in other fields. It's a highly-specialized calling and one deserving greater recognition. Precedent has been established. Plant maintenance engineers enjoy a distinct status; why not maintenance engineers in our field?

BPE

ADVANCED DESIGN PISTONS

By GILLETT AND EATON

for Longer Heavy Duty Service

TROUBLE-FREE with thousands in use

★ Low initial cost... Low cost per mile

★ Amazing increase in piston life

★ Maintains new engine power and performance

WIRE INSERTS PUT CAST IRON WEAR IN TOP RING GROOVE

G and E Wire Insert Piston before machining (left) and after ring grooves are cut (right) showing how the steel wire forms a tough wear-resisting surface on both faces of top ring groove. The patented ferrous plug molded in the head (for diesel pistons) prevents burning through head and lengthens diesel piston life!

With the thousands of G and E "Wire Insert" Pistons in use for periods up to 3 years—a phenomenal record for trouble-free operation has been established. The "Wire Insert" greatly reduces top ring groove wear and increases piston life.

The "Wire Insert" piston design—exclusive with G and E—combines all the advantages of aluminum alloy pistons with the long life of steel in the top ring groove lands. No noticeable increase in weight—unequalled for rapid heat flow—and at low cost.

A pre-shaped steel wire is cast into the piston where the top ring is located. When the grooves are machined, the closely spaced wire surfaces form hard bearing areas on top and bottom faces of the groove. Result—reduced ring land wear, longer piston life at lower cost.

Get the G and E Wire Insert story today.

as LIGHT as aluminum...wears LIKE IRON

VANASIL Pistons have repeatedly run way over 200,000 miles with only .002" to .005" wear on the top ring grooves. On-the-road ring breakdowns caused by badly worn grooves are almost eliminated because *Vanasil Pistons reduce top ring groove wear up to 75%!* Nothing else compares with the genuine G & E Vanasil —the original high Silicon aluminum alloy, proven by 19 years of use.

You Get ALL These Advantages Only In

GENUINE VANASIL PISTONS

G & E PROVED Vanadium...High Silicon...Aluminum Alloy

1. LIGHT WEIGHT—Same as other aluminum alloys.
2. SCORING, SCUFFING MINIMIZED—Because of "Oil Absorbing" microscopic porous texture.
3. LONGER LIFE—30% less friction—30% harder. Greater "hot strength"—see chart at right.
4. TOP RING—Breakage virtually eliminated because of reduced ring groove wear.
5. LOW EXPANSION—Characteristics of Cast Iron.
6. CLOSE CLEARANCES—Fitted with Cast Iron Clearances.
7. SOLID SKIRT DESIGN—No expansion devices required.
8. HIGH HEAT CONDUCTIVITY—Similar to other aluminum alloys.
9. PLATING—No tin or other break-in coating required.

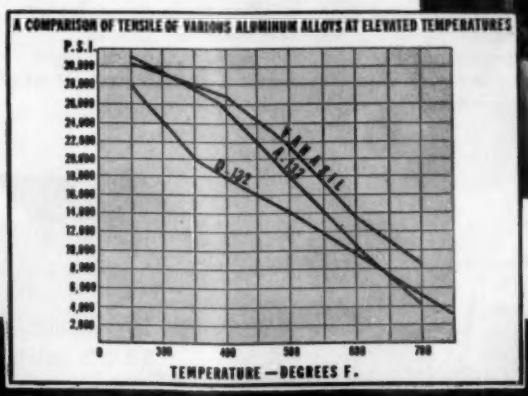
VANASIL PISTON WAREHOUSE STOCKS

CALIFORNIA—Automotive & Industrial Whse. Co., 1341 So. Hope St., Los Angeles 15; Piston Supply Warehouse, 2768 Grove St., Oakland 12

NEW YORK—Bethlehem Equipment Co., 109 W. 64th St., New York 23

VANASIL* "OIL-ABSORBING" PISTONS FOR GASOLINE AND DIESEL ENGINES

*Gillett & Eaton's trademark for a vanadium... high silicon... aluminum alloy.



Write for complete information and prices on Gillett and Eaton's Wire Insert and Vanasil longer lived pistons.

"Our 90th Anniversary Year"

GILLETT and EATON, Inc.

846 DOUGHTY STREET
LAKE CITY, MINNESOTA

highlights

Trucking industry in Pennsylvania will flourish, according to G. W. Rutland, Jr., American Trucking Association president. More than 150 new plants have been built in this state during the past ten years under the Pennsylvania Plan for attracting new industries there. Nearly every one of these new plants is located in an area where only trucks can haul material to and from them.

Steel of future may be lightweight paper thin and more durable. Scientists are reported by "Steelways" (American Iron and Steel Institute) on threshold of major breakthrough in controlling atomic structures that determine steel behavior. Results will be steels of fantastic strength, structural principles permitting far less weight and bulk, reliability yet unheard of. Think of the durable lightweight diesels that use of this steel will permit—if and when.

A farm equipment maker has improved business through aggressive management. Minneapolis-Moline's third quarter operating income was more than double that of the corresponding 1957 period. Lowered operating costs, success in recruiting new dealers, and programs to increase company and dealer sales to farmers and industrial users are the reasons, according to J. Russell Duncan, company president.

A new law opens up a whole new area of truck financing. Effective January 1, 1959, it provides that recordation of a vehicle lien in any one state shall be recognized as valid by any other state, thus assuring banks and other lending agencies of additional security. This will encourage granting of loans to motor carriers (subject to ICC regulations) buying certain types of tractors and trailers.

F. Perkins Ltd. mobile diesel school has completed a 9-month Argentina and Uruguay tour. British Dodge 2-3 ton chassis with Perkins P4(V) diesel carried equipment for schooling in diesel theory, maintenance and trouble shooting. Reception was enthusiastic both as an opportunity for technical instruction and as a British good will gesture. American engine builders might well take note.

Electronic "brains" now understand words. U. S. Air Force's Air Material Command and Remington Rand Division, Sperry Rand Corp. have jointly developed a method for using a limited number of English verbs to instruct the computers. Simplifies programming and thus training of programming personnel. And imagine the satisfaction of telling what's to be done—and have it done.

Railway diesel maintenance is advanced by new, simple method for cleaning engine air boxes. With old method, mechanic applied solvent and mopped away residue by hand, carefully keeping strong solvent off cylinders, pistons, rings and hands. Engine-protective covers are used in new system and solvent is sprayed on. Bulk of oil residues run down and are drained off without touching mechanic's hands. Time saving is about one hour.

Gas turbine cars will be superior to any piston engine car the Chrysler Corp. can foresee, according to Paul C. Ackerman, company vice president engineering. He said this superiority would apply to fuel economy, mechanical reliability and vibration-free operation. However, he could not say when or if the Chrysler Corp. will be in a position to bring to market their first turbine-powered car.

Penn-Texas Corp. will control Fairbanks, Morse & Co. They have finally won a two-year proxy battle for control of F-M & Co., makers of diesels, pumps, compressors, electrical equipment, and other products. Buying of a large block of shares has given Penn-Texas about 77% of F-M shares and made F-M & Co. their subsidiary. Penn-Texas biggest operating unit is Pratt & Whitney Co. Other subsidiaries include makers of firearms, and plastics and coal mining.

Two special diesel tractors are being developed by Army engineers at Fort Belvoir, Va. They are rubber-tired and crawler versions of ballastable machines that have multi-purpose capabilities and can be air-transported and air-dropped. The new units are designed for increased mobility, reduced operator needs, reduced maintenance skills, reduced need for transport vehicles of all types, and reduced logistical support.

Plant layout of the Chrome Crankshaft Company, Inc., in Los Angeles, California. Plating tanks are seen at the right in rear and all the specialized machinery is lined up along the walls.

Stretching Crankshaft Life By Chroming

A worn but sound crankshaft still has a long life potential. When reclaimed by chrome plating, its useful life is further stretched. Advantages of longer life and restoration to standard dimensions are obtained at much less than new-shaft cost.

WEAR records chalked up by crankshafts reclaimed by chrome plating speak well for the process. But its not as simple as it looks. Even experienced platers are kept on their toes continuously meeting the many exacting requirements of the preparatory, plating and finish operations.

Getting even plating on the main journals and offset crankpin journals at the same time is not easy. The mechanics of handling and rotating the shaft to do this are quite intricate. Special jigs are used which must be developed by the platers.

Yet plating is only one important step. Many others must be carried out precisely. For example there's also inspection, straightening, pregrinding and then the plating. Following this then there is stress relieving, final grind, polishing and final inspection. Cleaning takes place several times.

The plating process has its own problems. Jigs and fixtures for handling rotation, anode design, bath control—all must be done right.

Here's how one plater from the West Coast, Chrome Crankshaft Co., Inc., has solved these problems. Let's see how they process a worn or damaged shaft from beginning to end.

Preliminary Work

The impression you get on entering this plant is one of complete orderliness, not only in machinery arrangement but also in the manner in which each machinist does his job. Each shaft is assigned a serial number and given an order ticket. Fifty items on this ticket must be filled out in detail as the shaft progresses from initial inspection to final inspection and crating. One copy of this ticket is sent with the shaft and gives a complete picture of the shaft damage and the repairs that were made.

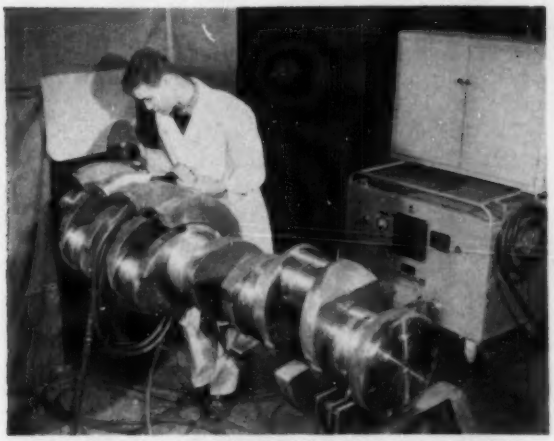
After the customer's name and make of crankshaft are recorded on the ticket, the time started is written in and the crankshaft is on its way. First it is cleaned by hand, there are no cleaning tanks or dip tanks used. Oil plugs are then removed and oil passages are cleaned. Then the shaft is checked for alignment. If necessary it is straightened by the impact process. Briefly this involves rotating a shaft on vee-blocks and locating high and low spots with a dial indicator, then eliminating them.

Next, the shaft is checked for runout of centers and trued up. On shafts such as that for the EMD 567, the center flange is checked for looseness and if necessary is repaired. Counterweights are measured and if necessary they are straightened.

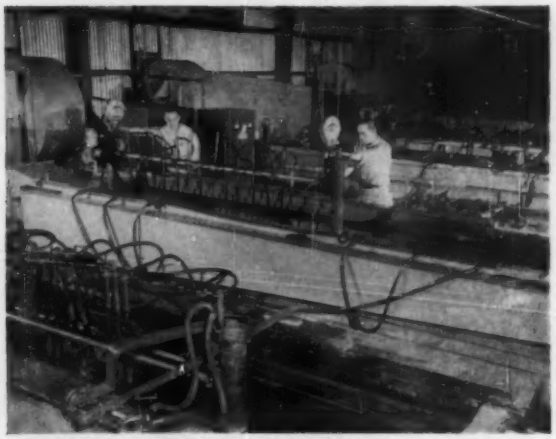
Rod and main journal diameters are checked and recorded on the sheet. Any pin holes in the journals are noted as well as any other defects. These are also recorded.

After this initial inspection comes the pregrind. A minimum of 0.010-in. is allowed to bring the shaft back up to size. It is interesting to note that they maintain the same tolerance on pregrind as on finished grind. According to Mr. L. A. Booker, the company President, the reason for this is greater accuracy and basic uniformity.

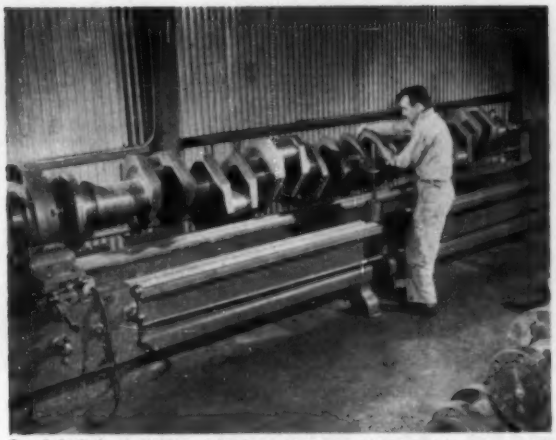
All journals are ground straight and round and with proper geometric relationship. Just centering on the least diameter and grinding it round would throw off



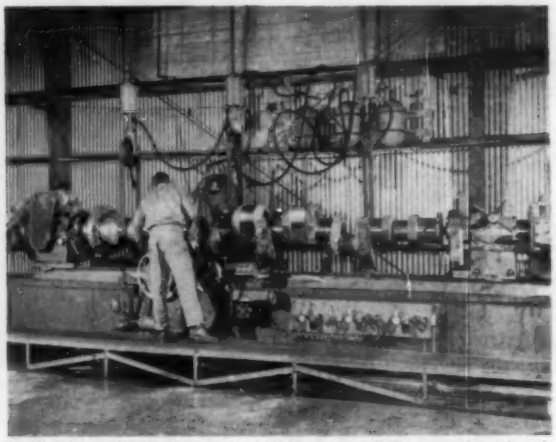
Magnetic particle inspection by skilled, highly-trained specialists, shows up any cracks or other defects in the crankshaft.



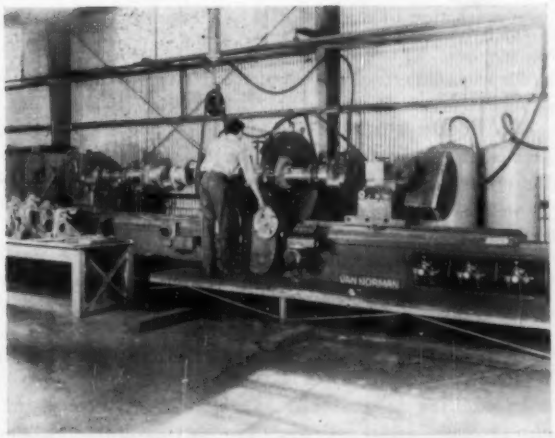
Crankshaft, chemically clean, is installed in a special rotary fixture which rotates shaft in plating tank. Anodes and shields are then applied. Here, tanks, anodes and rotary fixture are seen.



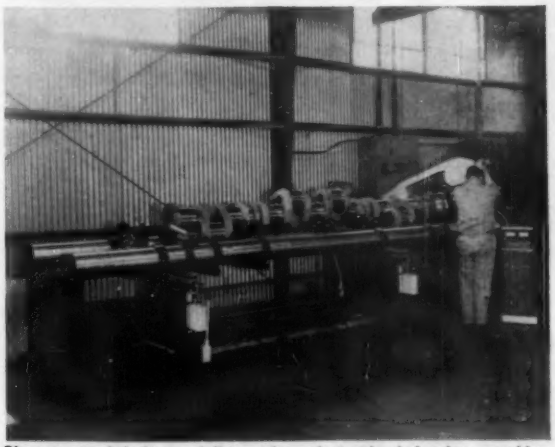
Crankshaft is straightened by impact process if out of alignment. It is rotated on vee-blocks and high and low spots found and eliminated.



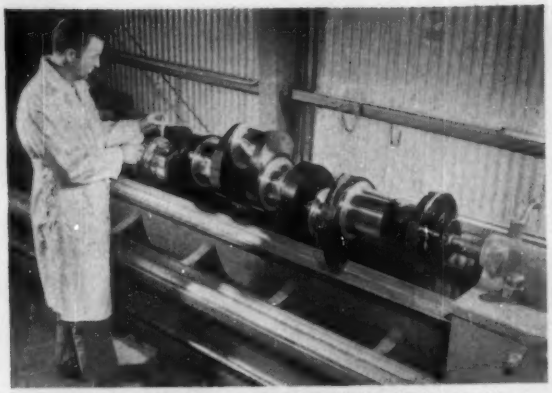
In finish grinding, journal surfaces are carefully ground and polished to original manufacturer's specs on Van Norman grinder. Overhead load compensators prevent sag in extra long, heavy shafts.



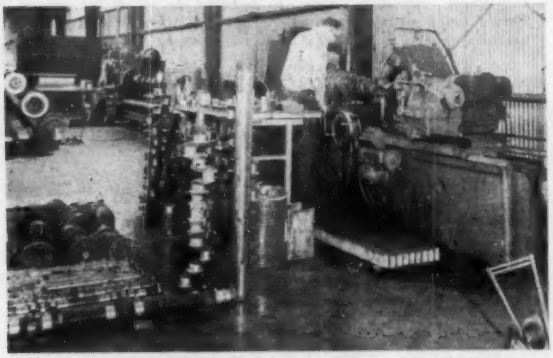
During pregrind, defects on journal surfaces are removed on Van Norman grinder and any dimensional irregularities corrected.



Chrome crankshaft specialist, using electronic balancing machine, rebalances crankshafts to original dynamic balance requirements.



Journal is checked with micrometer during final inspection.



Some of the many parts plated by the Chrome Crankshaft Co. are seen in front of Van Norman grinder, included are some camshafts.

the stroke or angular relationship of the pins. Therefore the pins must be properly trued up and indexed during pregrind to insure an equal chrome thickness at the finish grind. During pregrind, both front and rear flanges are faced true if necessary.

By use of special methods, Mr. Booker says that they have increased speed of these grinding operations. At the end of the pregrind the shaft is again thoroughly inspected. If this inspection is satisfactory the shaft is sent out to be Magnafluxed. A certificate of this Magnaflux check goes with every shaft. If this inspection shows no minute cracks or flaws the shaft goes on to be plated. If serious damage shows up it is discarded.

After the pregrind and Magnaglo inspection, the shaft is shot peened. Not all journals are peened alike. The amount of peening varies in accordance with shaft damage, hardness and/or steel analysis. The purpose of shot peening is to increase fatigue life and the endurance limit of the shaft.

After the shaft has been peened, it is cleaned for plating and here Mr. Booker insists that the shaft must be hygienically clean and that this cannot be over-emphasized. He has devised a special way of cleaning his anodes. He makes a special inspection both of the shaft and the anodes to be sure that there are no foreign bodies which would throw off the plating operation.

Chrome Plating

Special anodes are used which are unique for plating a shaft while it is rotating. This design definitely speeds up the time in the plating tank.

The time the plating is started is carefully recorded as is the current flow to each rod and main journal. Measurements of the plating thickness on all rod journals are also recorded. According to Mr. Booker, this is an additional way to assure quality control and to avoid excessive grind stock or excessive plating, both of which take time and cutdown on the profit per shaft. There are times however when additional plating on either rod or main journals is required because of excessive wear.

When the shaft is removed from the tank it is inspected to make sure that no defects are visible. If satisfactory, anodes and jig are dismantled.

Finish Operations

Now the shaft is ready for finish grinding. It goes through the same careful procedure followed in pregrind. All the main and pin journals are ground to the original size and no undersize journals are used unless specified by the customer. Special grinding wheels are used that give a finish in the grinder which keeps final polishing to a minimum. The flanges are faced and rechecked for algniment. Then oil holes are faired.

After all bearing surfaces are polished, runout is again checked, oil passages are cleaned and the plugs installed.

Every crankshaft is dynamically balanced in the Chrome Crankshaft process. A specialist using an electronic balancing machine, rebalances crankshafts to original dynamic balance requirements.

After final inspection, the shaft is oiled, wrapped and crated for shipping.

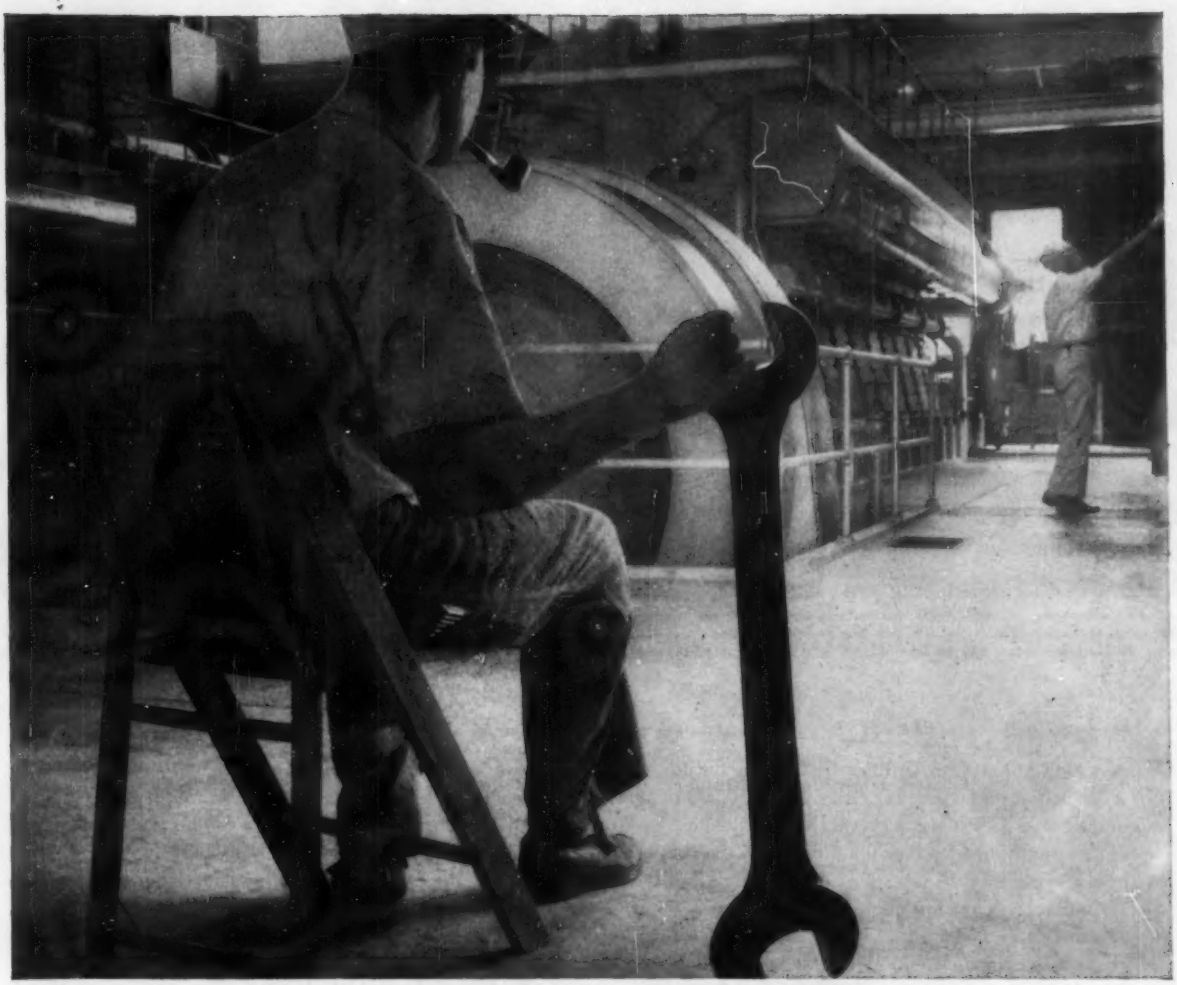
During this entire process, the most careful attention is given to all crankshafts by skilled craftsmen working with the most modern equipment. This produces a shaft of the original manufacturer's dimensions and tolerances —at a fraction of the cost of a new crankshaft.

Conclusion

Mr. Booker attributes the success of his shop to his personnel relations program. This is built to bring out the craftsmanship of every member of the organization, as well as a feeling of mutual responsibility and satisfaction of achievement.

In terms of sales, Mr. Booker believes that customers are his best salesmen. By emphasizing quality and customer satisfaction, these customers become an extension of his sales-arm and almost all of his new business comes from recommendations of existing customers.

In addition to customer satisfaction, customers are also protected under a Product Liability Insurance Policy and a new crankshaft warranty.



The case of the unused wrench

How know-how and Cities Service Oil pay off for Easton Utilities Commission

Take five men with 111 years' experience in power plant operation . . . add Cities Service DC-300 Lube Oil . . . and you can retire the big overhaul wrench to the nearest rocking chair.

That's precisely what Easton Utilities Commission of Easton, Maryland has done!

Under the management of Supt. William Krumbine (41 yrs. experience) and his team of specialists, overhauls and maintenance problems have become a rarity.

Take the generator pictured above. Using Cities Service DC-300 Oil, they've had it operating 600 to 700 hours a month for over three years without losing a bearing or a piston . . . and without even changing oil! Oil is added, but never changed, thanks to its unusual stability and outstanding detergent-dispersant characteristics. Compression, fire pressure, and fuel economy are excellent.

If you're looking for a lube oil that can reduce friction, resist oxidation, and boost fuel economy, talk with a Cities Service Diesel Lubrication Engineer. Call the nearest office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

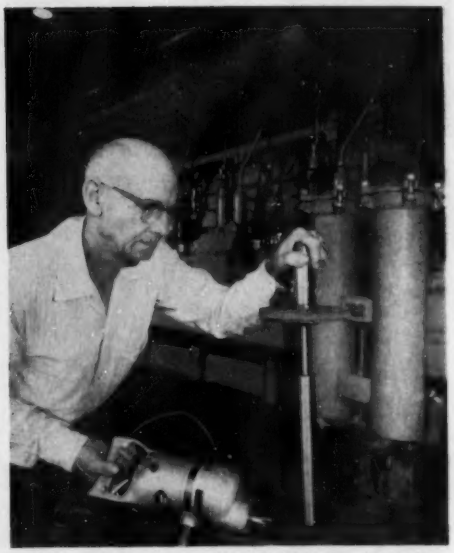
111 YEARS' COMBINED EXPERIENCE is shared by five men responsible for Easton's outstanding maintenance record. Sticklers for efficiency, they are unstinting in praise for Cities Service DC-300 Lube Oil.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Valve Maintenance Improves Operating Efficiency

By Ray Hall
Chief Engineer, Nebraska City Utilities, Nebraska City, Neb.



Equipment for valve seating. Wheel face is trued, specially-engineered arbor is inserted in valve guide and heavy-duty driver spins stone at 4000 rpm.

Low power rates at Nebraska City Utilities hinge on high engine operating efficiency. High engine efficiency hinges on good maintenance. Here's how one phase of their maintenance—valve reconditioning—is handled and how it affects overall performance.

NEBRASKA City Utilities has one of the lowest residential power rate for cities under 10,000 population in the State. An extensive preventive maintenance program in this 4-unit diesel power plant has been the prime factor in achieving this.

Construction on the plant was started in 1951. It was designed for a dual-fuel system utilizing diesel power (natural gas or oil). Our first unit, a Nordberg 2120-hp, 4-cycle engine powering a 1500-kw Elliot generator, went on the line in 1952. This unit has been running continuously since that time. It has compiled a total of 27,000 hours of operation.

In 1953 we installed our second unit, another Nordberg 2120-hp, 4-cycle engine. This one powers a General Electric 1500-kw generator. This engine has run a total of approximately 26,000 hours.

The third unit was installed in 1955. This was a 3500-hp Fairbanks-Morse, 2-cycle engine driving a 2500-kw Fairbanks-Morse generator. Total operation time on this engine is about 25,000 hours.

The fourth unit, a 4350-hp Nordberg, operating a 3100-kw General Electric generator, started operation in 1957. This unit has run approximately 3700 hours to date. Installation of this unit brought our total horsepower up to 12,050, producing a capacity of 8600 kw. With this we serve Nebraska City and 12 other surrounding towns in addition to 467 rural customers.

In all four units, compression pressure is still exactly the same as when they were new. This, in spite of the fact that three of the engines have run over 25,000 hours. This means of course, that we are obtaining optimum efficiency and utilization of fuel. The major reason for this is our valve maintenance program.

The Economics of Good Tooling

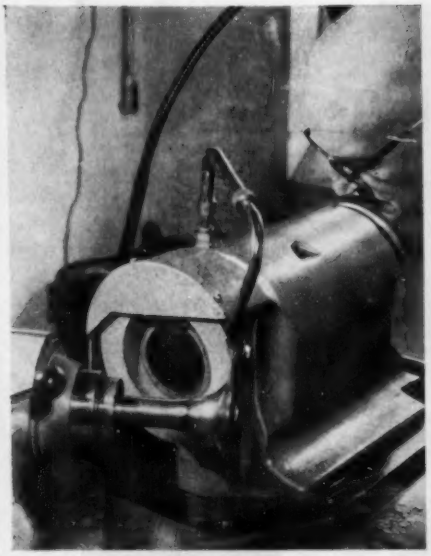
Since there is a definite relationship between operating efficiency and the condition of our valve faces and seats, we maintain constant vigilance on engine compression. Because we have efficient valve grinding equipment on hand, we can, and do maintain the seating of valves to a near-zero tolerance without endangering plant continuity.

Purchase of our valve grinding equipment in March 1955, has given us a preventive maintenance advantage in servicing the 208 valves on our four diesel engines. It has resulted in a 1% to 2% fuel savings which in less than three years will pay out the original investment in the equipment. This does not take into consideration the great saving in labor over our previous hand-grinding methods, or cost and time saving of having our valves refaced by commercial concerns.

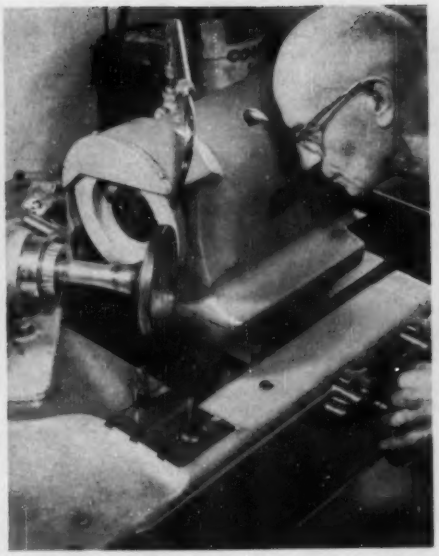
Assuming a 1% fuel savings as a direct result of our valve and valve seat grinding techniques (actually it is closer to 2%), our annual fuel saving would be $705. Discounting the other advantages of the Sioux equipment, we justified its purchase on the basis of a 3-year pay out on fuel savings. Thus, based on the 1% figure alone, our decision to buy this valve-servicing equipment has been justified.

Valve Maintenance

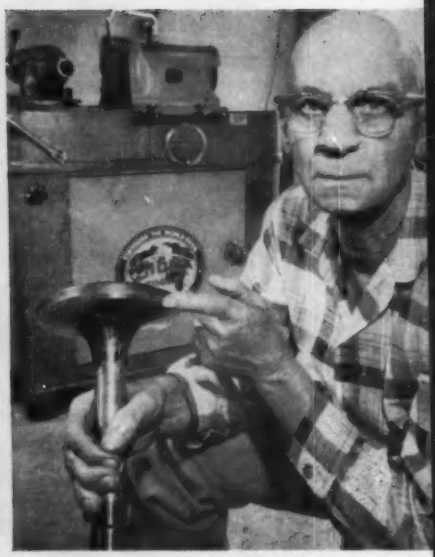
With full-load operating pressures on our gas valves at 750 to 800 psi, we find it essential to shoot for a zero tolerance on seating of all valves. Our compression checks indicate that we are getting it consistently. Valve sizes range from 1-1/4-in. diameter up to 5-in. on the exhaust and intake valves of the 4-cycle engines. On the



Ray Hall checks set-up for refacing valve in Sioux grinder. Wheel has been trued, chuck mounting set at the correct face angle and the valve chucked.



After correct set-up, valve is refaced on wet grinder. Correct face angle and finish are reproduced many times faster than earlier hand-grinding method.



Finished valve face is concentric, at correct angle and has a high finish. Job is done rapidly and with just enough of the metal removed for proper cleanup.

two 4-cycle units, we have a total of 64 valves per engine—16 gas valves, 16 exhaust valves, 16 intake valves, and 16 air start valves. The 2-cycle units have a total of 38 valves—19 gas valves and 19 air start valves.

Prior to the purchase of our valve grinding equipment 2-1/2 years ago, we were engaged in a completely manual operation in which we ground valve and seat together in the head by hand, averaging 15 to 20 minutes per valve. This method, at best, was a hard, back-breaking job which involved a lot of turning. Now, we grind all 64 valves in one of the 4-cycle engines in approximately 15 minutes—less than the time it formerly took for one.

It is not unusual to develop ridges on valves and seats of as much as 1/16-in. By the hand-grinding method, if any clearance existed in the guide, we would hit these ridges and be involved in an all-day grinding operation before we could begin to seat the valve. Now, the Sioux machine removes these ridges immediately and we can complete the operation in minutes rather than hours.

As a further service, Sioux engineers worked with Fairbanks-Morse and Nordberg engineers to design the correct taper for the arbors we use in refacing the seats. This meant that we were ready to go to work as soon as we received the machines without the awkward task of working with different tapers for the various engines.

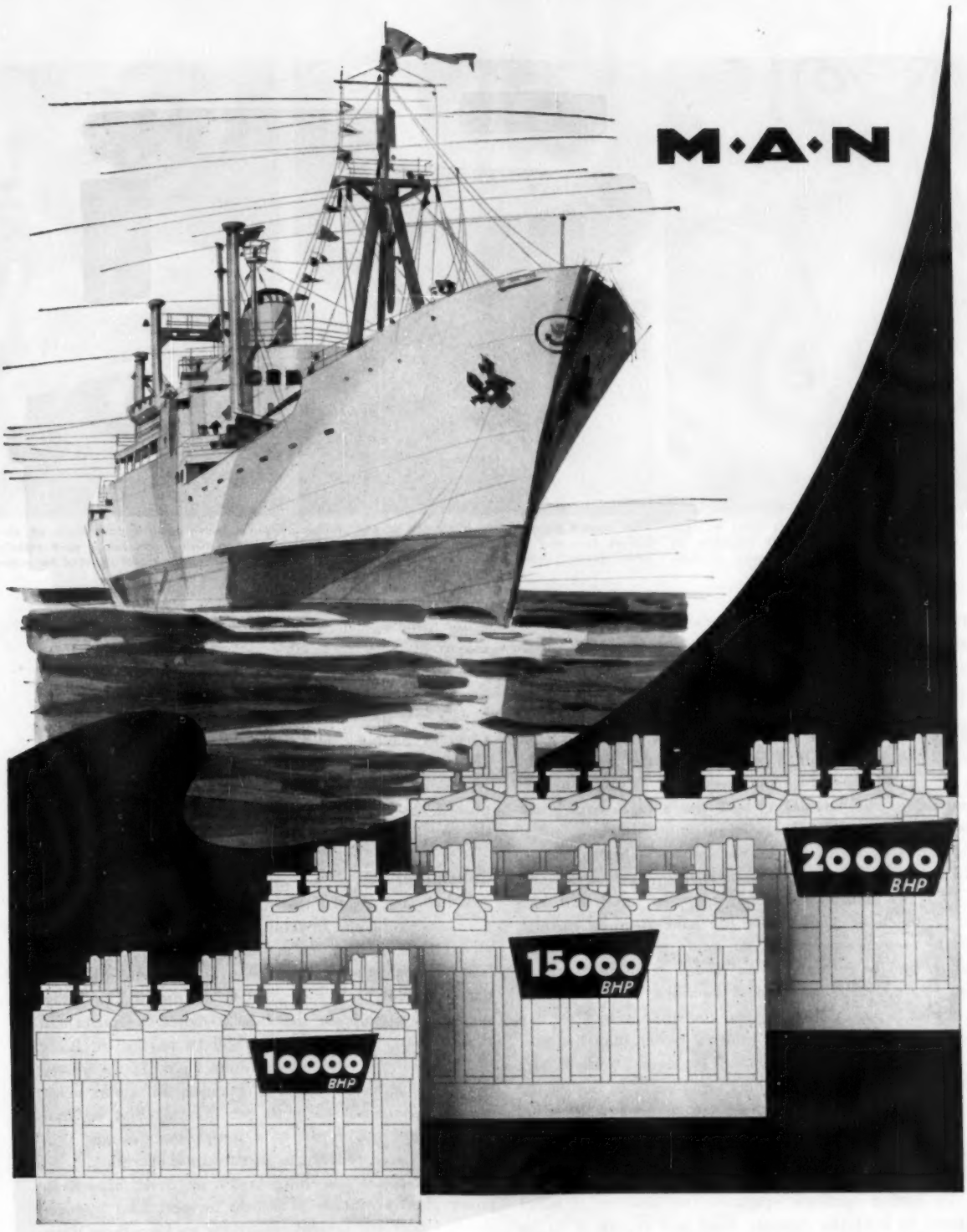
To further facilitate operation, we designed a stand fixture to hold the cylinder head and permit it to be turned upside down for valve seat grinding. As soon as the head is removed from the engine, it is placed in this stand and the valves removed and cleaned. All carbon and grease is eradicated from the face at this time. We then true-up the grinding wheel. The valves on the Nordberg unit are ground at a 33-deg angle and on the F-M at a 45 deg angle. After grinding they are polished with a fine grinding compound. The valves are then ready for reassembly into the head.

We then utilize the special tapered mandrels, fitting them into valve guides for valve seat grinding. We also have a seat tester to check concentricity and so indicate when we have a true grind. The top of the mandrel is keyed for insertion of a 4000-rpm heavy-duty driver which is utilized for seat grinding. Once this is accomplished, we complete final hand lapping of the valve to the seat for a few minutes.

Conclusion

We do not regard this valve grinding operation as maintenance at all. In truth, availability of this equipment in the shop is our guarantee against maintenance. More important, we have the assurance that we are doing the job the only right way .Also, we are not running into a time delay in shipping the units 40 miles to Omaha and then running the risk that we will be paying for labor and the job will still not be done right. If we wasted money in such an inefficient manner, we could never achieve the record low cost per kilowatt that we now enjoy. What was formerly a major maintenance procedure has been reduced to a spare time operation.

Of course, the one thing that must never happen in power plant operation in failure to meet load requirements. Under our present conditions we keep three units on the line at all times. During the months of July and August we have all four units operating. Obviously, we would be in real trouble at peak demand if we had to engage in major maintenance program on our valves. If we had to send our valves out to a machine shop, we would have to be prepared to live with a 3 to 4-day delivery schedule which, of course, we cannot tolerate.



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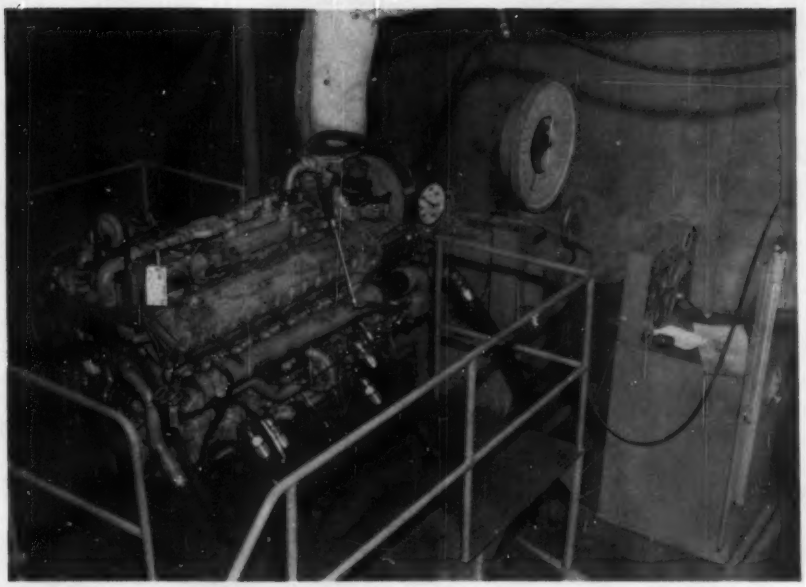


Packard diesel is run-in on Maxwell dynamometer (at right of engine) for 16 hours, after engine was rebuilt. Engine is remote-controlled through console in front of dynamometer. Note manometer attached to console. Flexible hose for fuel, lube oil, and water makes hook-up to the test stand quick and easy.

Build your maintenance program around an — —

Engine Dynamometer

By John A. Grunigan
General Manager, Maxwell Dynamometer Co.

Here is what dynamometers will do along with some suggestions in planning their installation and use.

WHEN you hear the word "dynamometer", what does it mean to you? Do you get the picture of a fancy laboratory gadget for measuring horsepower—something nice to have in the shop if you could afford it? Or do you see a rugged, practical shop tool, something around which to build your service program?

Those who have and use them know that the second picture is the right one. They know that they do much more than just measure horsepower. And they also know that they pay off in so many ways that it is not a question as to whether you can afford one but whether you can afford not to have one.

The dynamometer room automatically becomes a quality control center. It tells the maintenance supervisor or shop foreman a lot about his shop. Repetitive troubles or occasional goofs are caught in the testing process and appropriate corrective action can be taken. A lot of costly re-do work can be avoided in this way.

With the dynamometer, rebuilt engines can be properly broken in under controlled load. Throughout the break-in process and right up to the full-load runs, opportunity is afforded for correction of troubles and making of adjustments, including proper torquing. When the engine meets the standards set, the engine is ready to go out—and stay out.

All this is worth dollars and cents in maintenance costs. It's a way to monitor shop procedures and reduce the expense of re-do work. Troubles are caught in the shop where they are least expensive to correct. You turn out an engine ready to accept its full load without possibility of injury. Its proven quality minimizes chance of comebacks. Service calls or warranty, as the case may be, are always expensive.

So far, we've been talking about engine dynamometers. There are also chassis dynamometers for checking a vehicle and its components, including the engine. These are equally valuable as a shop tool but their nature and application are different. That's another story. Here, we'll discuss an engine dynamometer, how it works, some ideas on setting it up and how to use it.

How the Dynamometer Works

Performance testing and controlled under-load break-in of rebuilt engines requires a means of loading the engine and absorbing its power. We do this with a hydraulic

brake. The power absorption unit is basically a centrifugal pump in which the head or resistance to flow is controllable so as to vary the load on the impeller, hence, on the engine that drives it.

In our design, the brake housing is always full of water and the unit's power absorption capacity is varied by adjustment of sluice gates in the flow circuit. A feature of this system, opposed to those in which the amount of water in the circuit is varied to change the power absorption characteristics, is that a pre-determined and reproducible torque absorption is obtained at any given gate setting.

The operational principle is simple. As the gates are set to increase resistance to flow, more torque is required to turn the impeller. This torque, supplied by the engine, produces an equal and opposite torque in the pivoted housing. This reaction torque is measured on an accurate beam-type scale and is shown on a dial calibrated to give direct torque readings in foot-pounds.

Engine rpm is obtained from a tachometer, either engine-mounted or incorporated in the dynamometer as desired. With torque and rpm known, brake horsepower for the particular operating conditions are easily calculated.

The hydraulic brake or torque absorption unit is the heart of the dynamometer. Each model has its own envelope curve showing the horsepower-rpm combinations for which it is suitable. The best size is picked on the basis of the size range and characteristics of the engines to be handled. Beyond this, method of mounting engines, drive connections, additional instrumentation and systems for engine operation can be tailored to suit the operation.

Installational Ideas

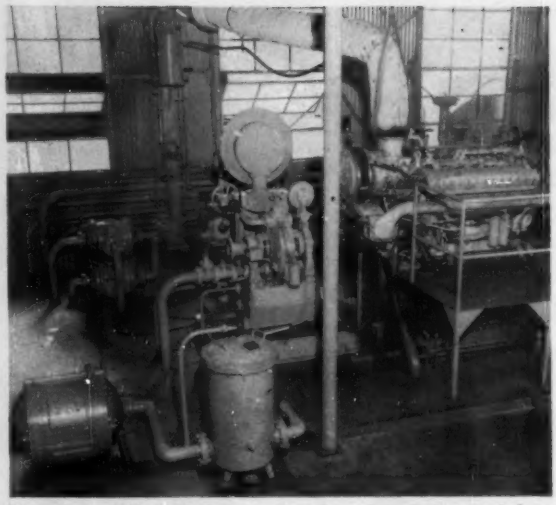
No two shops are alike. Type, size and volume of engines handled, physical restrictions imposed by buildings and individual ideas all affect the work-flow pattern. Therefore, when you get beyond the basic unit some flexibility is required.

Dynamometer testing is the last step in the operation. Logically, then, the test area should be close to where the engine work is completed. You'll want good handling and lifting facilities for fast and convenient delivery and mounting of engines for test. The same is true for disposition of finished engines.

Dynamometers may be furnished as a unit, separate from the engine-mounting base, or can be integral with it. The ideal engine base should have a series of inverted "T" slots or some similar arrangement for flexibility in locating the engine supports. Adjustable screw-jack supports have been working out for engine mounting. For engines with SAE housings at the flywheel end, ring mountings that are adjustable for a range of sizes are available.

The point is that a minimum amount of time should be needed for handling and setup. This can be considered non-productive time. This also applies with regards to attaching drive connections, instrumentation and auxiliary engine systems.

An automotive-type drive shaft with universal joints is commonly used to connect engine and dynamometer. For higher speeds, more constant velocity and where only slight misalignment is to be compensated, shafts with gear, rubber or spring-type couplings can be used. The last two coupling types have the advantage of isolating torsional vibrations as well.



Rear view of Maxwell dynamometer shows how it is mounted on one stand while 600-hp Packard diesel being run-in by Navy is mounted on a separate one. Auxiliary lube oil pump and filter for engine are at front left. Auxiliary water pumps are at left in rear.

Basic instrumentation should include the tachometer mentioned, oil pressure and water temperature gauges. From here on, you can tailor the additional instrumentation setup for the jobs you want to do. And the dynamometer room is the place to do all your performance testing.

You'll need auxiliary engine systems. Most engines tested will be without radiators and need a cooling system. Generally, a standpipe type of system is provided.

The hydraulic brake will also require a water supply. A valved water line can be run to the unit and the discharge run to waste or where water is a problem, a recirculating system with tank and pump can be used.

The fuel supply system should be large enough for a full testing cycle. This will avoid interruption of tests for filling. Be sure that the supply to the engine is well filtered.

Provision must be made for starting. A battery cart is a convenient means of handling electric starting. If air or hydraulic starters are involved, special provisions must be made.

Finally, we come to the exhaust system. This also brings up the subject of noise—exhaust noise and also engine noise. When testing in the shop, the noise level can be not only objectionable but distracting and has been known to affect safety adversely. You'd be well advised to locate the dynamometer in a separate building, its own room, or at least surround it with a sound-deadening inclosure.

Exhaust gases must be piped to the atmosphere. If located in a congested area and you want to be a good neighbor, install a silencer in the line. Use one with a capacity suitable for your largest engine and it will do a fairly good

(*Continued on Page 26*)

"Our Mack diesels are used for the country's roughest territory . . . but Purolator Air Filters keep their engines in top condition . . . keep our PM costs way down"

says Mr. Merle W. Bogan, Service Manager, Smith's Transfer, Staunton, Va.

PART of the operating terrain of Smith's Transfer—between Staunton, Va. and Charleston, W. Va.—is recognized by truck manufacturers and fleet operators as just about the toughest in the country . . . grueling mountain territory that demands maximum air filter and engine efficiency.

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To insure this outstanding performance, Smith's Transfer uses Purolator Air Filters exclusively. As part of a rigid PM procedure, the dry-type air filters are serviced regularly. Consequently, regardless of road or weather conditions, there has never been a power loss attributed to the air filter.

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(*Continued from Page 24*)

job over the whole range. Another thing, if you pipe up to this muffler's inlet size, exhaust back pressure will never be excessive in any engines tested.

Use a substantial length of flexible metal hose so that you can reach all the different exhaust manifold flange locations. Work out a set of adapters for fast and simple attachment.

Using the Dynamometer

A dynamometer room is the place for controlled underload break-in. It is also the place for all your tests and adjustments. Adjustments can be made under load and with the engine hot.

The purpose of break-in is to mate all the engine parts gently and gradually. Usually, this will be done by the time that rings are properly seated. Load and speed are gradually increased in accordance with a pre-determined schedule. You can follow the engine builder's schedule or work out a safe compromise procedure to meet your particular circumstances. Reduction of lube oil consumption to acceptable limits is a well-accepted criterion of break-in.

During break-in, various adjustments can be made and the performance of components noted. For example, the oil pressure relief valve can be set, valves readjusted, head bolts re-torqued, etc. If your instrumentation is set up for it, you can check intake manifold vacuums, exhaust temperatures and pressures, crankcase pressures, lube oil temperatures, fuel transfer pump suction and delivery pressures and many similar items.

If fuel consumption is desired, a flow meter can be used for engines with non-circulating fuel systems. For greater accuracy on all systems, weighed fuel tests can be run.

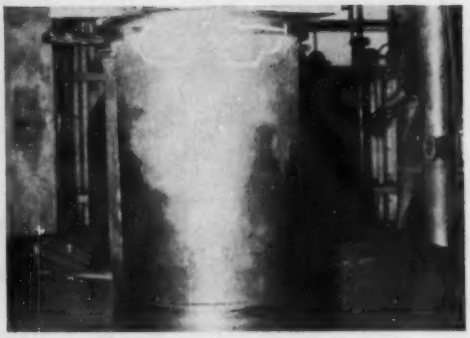
When the engine is ready for full load, you can plot a torque curve and compute a horsepower curve. If horsepower falls short, you have indication of some deficiency and can track it down. Perhaps gear train timing or injection pump timing is off. What ever it may be, you catch it in the shop and not as a performance complaint after the engine has left the shop.

Summary

You can build your whole service operation around a dynamometer. Far from being a laboratory instrument, this dynamometer is a rugged, practical shop tool for long hard service. It is accurately calibrated and holds calibration.

Your dynamometer room is your quality control center. It tells you how good your shop work is and pinpoints shop errors you can correct and prevent from reoccuring. There's no guesswork about the finished job. It is ready and able to deliver its full power.

Each step of the way you have the means to do a better job. You can test under various load and speed conditions right in the convenience of the shop and with greater accuracy than you can get in the field. You'll cut costs too. Re-do work will be cut and the cost of service calls and comebacks, both expensive, will be reduced to a bare minimum.



Plastic Steel Repairs Liner's Water Side

REPAIRS on liners corroded on the water side can be made quickly and cheaply with a plastic steel. As an example of what can be done with this compound, here's a case history of one of many jobs where it has been used successfully.

The Public Power Station of the Bahamas Electricity Corp., Nassau, Bahamas was faced with a shutdown. One of their 8-cyl diesels had to be repaired. Corrosion had eaten away a section on the water side of each liner and block. Replacement had to be avoided, if possible, since cost was too high. It involved $900 for each liner, or over $100,000 for the complete block.

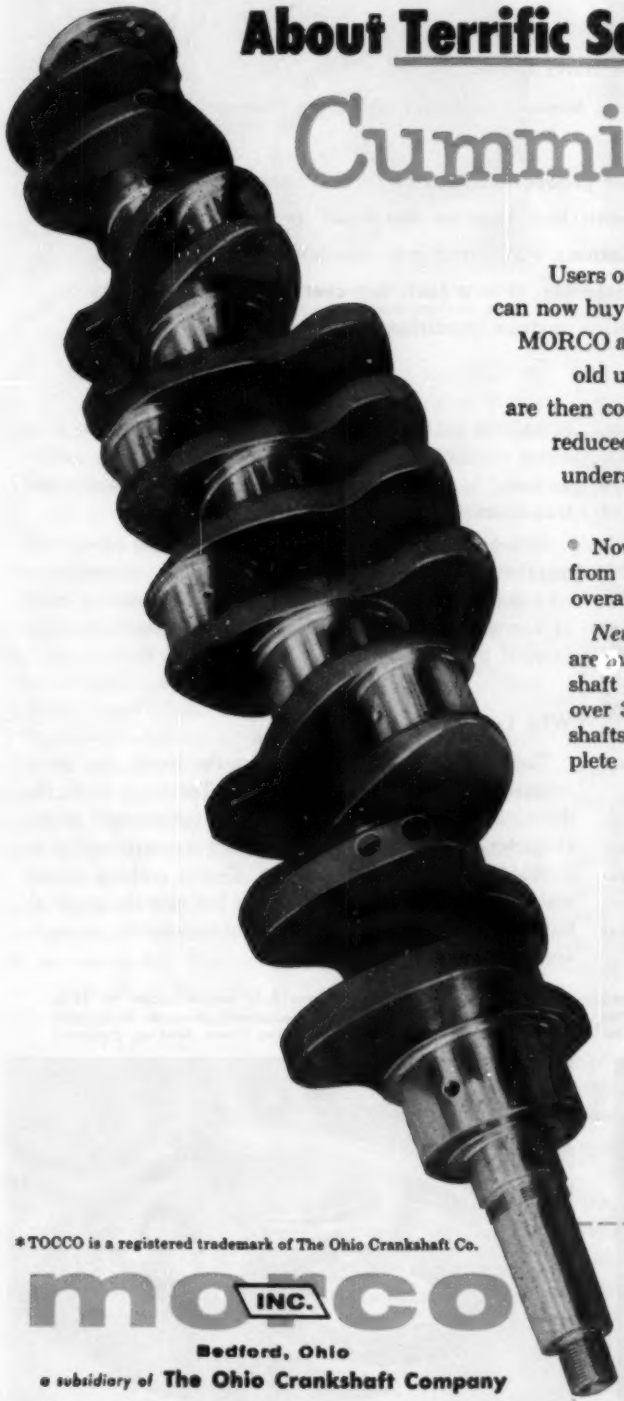
Welding seemed the logical solution. However, welders would have had to come from Miami, Florida. This meant paying their transportation costs, living expenses, and a wage rate of $8.00 per hour. In addition, since welding cast steel is a slow and difficult process, the job would have taken one week.

The company decided to try "Plastic Steel", made by Devcon Corp., Danvers, Mass. This compound, made up of 80% steel and 20% plastic, hardens to steel-like strength two hours after mixing with a hardening agent. No heat, pressure, or special skill is required for mixing or for using. It has extremely high bonding ability with cast iron, steel, bronze, aluminum, etc.

To use this compound, all liners were removed and both liners and block were cleaned thoroughly. Plastic Steel "A" and "B" were applied to the water side of the liners and block and allowed to harden. The surface was then ground to exact tolerance, and the units reassembled and put into operation. Only 2 lb of Plastic Steel "A" and 1 lb of Plastic Steel "B" were used, costing less than $10. Total working time for the repairs was 8 hours—quite a saving in both time and money as compared to replacement or welding.

Important News

About Terrific Savings for Users of Cummins Engines



Users of Cummins "H" and "NH" Diesel Engines can now buy *new* standard size crankshafts from MORCO and secure liberal trade-in allowances on their old undersize shafts! These undersize shafts are then completely reconditioned and sold at reduced prices depending upon the degree of undersize involved. Your savings? Tremendous!

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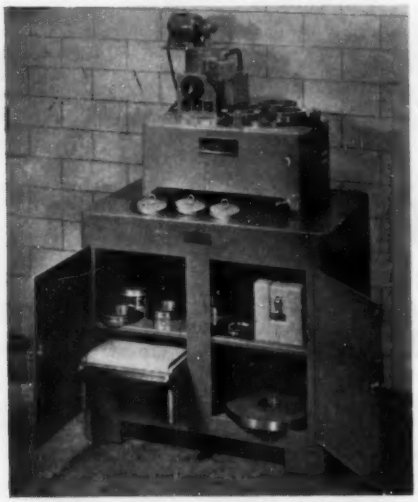


Lapmaster "12" with 12-in. lapping plate. On plate are three conditioning rings. Lapping compound agitator tank is below motor at left. Monochromatic light is in cabinet (top right), also conditioning rings.

Machine Lapping For Flatness And Finish

By Harry I. Sole

Sales Manager, Lapmaster Div., Crane Packing Co.

For production runs or in the shop, modern automatic flat lapping machines produce light-band flatness, fine finish and capability of distortionless assembly. It is a fast, low-cost technique for precision surface conditioning.

HIGHLY-finished and highly-flat surfaces seal better. They also permit distortionless precision assembly. These facts offer designers new scope when dealing with today's sealing problems that are involving higher and higher pressures. Attainment of these surfaces characteristics is entirely possible with modern flat-lapping machines and techniques.

Once a laborious, time-consuming and hence costly operation, flat-lapping is today a fast, low-cost, automatic machine operation, practical for the production line or shop. As a result, modern machinery design includes many direct surface-to-surface fits in which a high degree of flatness and finish provides high-pressure sealing and distortionless assembly.

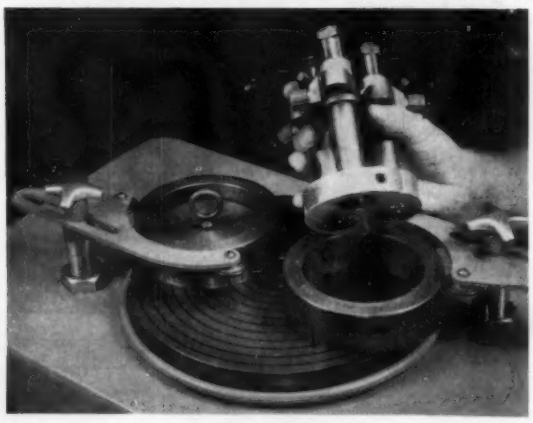
Two types of sealing may be involved—(a) sealing between surfaces that are stationary with respect to each other and (b) where relative motion is involved. A good example of (a) is found in injectors and fuel injection pumps where components, when clamped together, depend on direct surface contact to resist pressures upward of 2000-3000 psi. Axial-type seals are commonly used in water circulating pumps are typical of (b). Slide valves as found in railroad airbrake controls and on automatic transmission are another example.

As for precision assembly, the fuel injection equipment mentioned is a good example. This capability also explains why at least one engine builder flat-laps the mating faces of connecting rods and caps—no bore distortion when torqued.

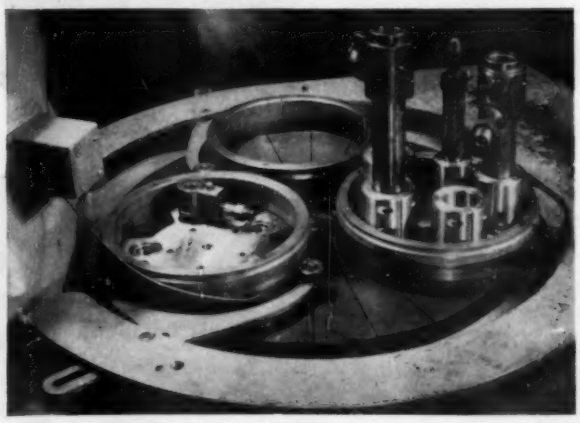
Why Lapping?

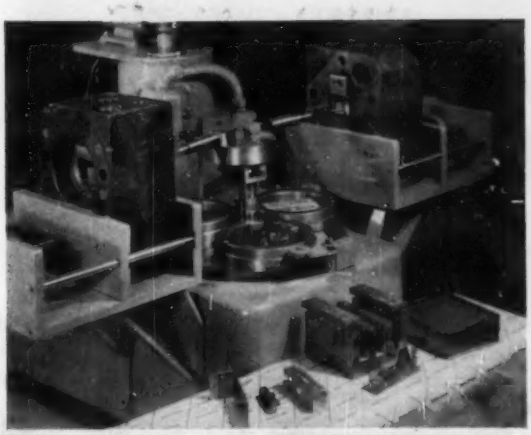
The flatter the surface and finer the finish, the more intimate is contact between surfaces. There are no voids due to lack of flatness or between the microscopic peaks characteristics of rough surfaces. High-pressure sealing is possible without resort to gaskets. There's nothing wrong with gaskets for routine sealing jobs but in many applications they are not only impractical but impossible—in seals and sliding valves for example.

At left, pressure plate is inside conditioning ring which is in contact with roller bar for rotating it while holding it in fixed radial position. Special fixture, right, holds nozzle bodies square with plate.

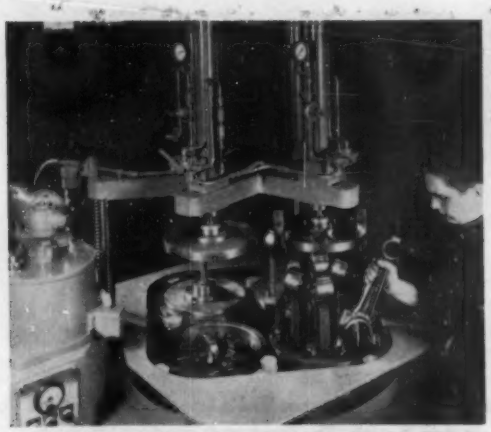


Various types of holding fixtures hold nozzle bodies to 12-in. lapping plate. Lapping plate in adjacent photo is 10-in. size. This is smallest model made by the Crane Packing Company.





Railroad application of flat lapping machine. Sliding valve seats in air brake blocks are being lapped at same time as parts on plate.



Lapping conrods and caps on Model 36 Lapmaster. Fixture above rods is slid down to hold rods upright.

So reliance is placed on surface-to-surface contact. Note use of "surface" rather than "metal". The reason is that many materials can be involved—ferrous and non-ferrous metals, carbon, graphite, ceramics, etc.

Flat-lapping techniques are flexible. Degree of flatness and surface finish can be controlled to suit the particular requirements. Basic control involves choice of type and size of abrasives used and length of the lapping cycle.

Take the case of a housing that when assembled to other components must be in close alignment and free from distortion. Gasketless construction is specified and only nominal pressures are to be sealed. Here, flatness is more important than finish.

Perhaps a relatively large amount of metal must be removed. It is possible to lap from the rough-machined state to final finish by use of a fairly coarse abrasive. Cycle time will probably be less than for the normal intermediate machining steps and flatness will be considerably better.

Take the other extreme. The face of a nozzle holder is to be lapped. Pressures running close to five figures are not uncommon and must be sealed when holder and nozzle are assembled. The surface must be almost dead flat and the finish in the order of three to five micro-inches. This is entirely possible by selection of the abrasive and adjustment of cycle time.

These examples demonstrate the flexibility of the process.

The Lapping Principle

Take two plates of any material. Put an abrasive between them and rub them together with an irregular motion. Ideally, every point on one plate, sooner or later, should contact every point on the other. High spots make first contact and, through cutting action of the abrasive, are removed. Keep it up long enough and you generate surfaces in complete contact.

In modern lapping machines, you start with one perfectly flat lapping plate and generate the flat surface on the workpiece. That's all there is to the basic principle of flat lapping but to make it a practical, low-cost machine process is a more complicated matter.

Flat-Lapping Machines

Start with the lapping plate. We build standard machines incorporating these in sizes from 10-in. to 72-in. diameter. Material is generally a special iron alloy, although other materials are used for special cases. Radial grooves provide a means of disposing of spent compound. Where a flange or shoulder on a part must be lapped, concentric grooves may be made in the plate for clearance so that the surface to be lapped makes contact with the lapping plate.

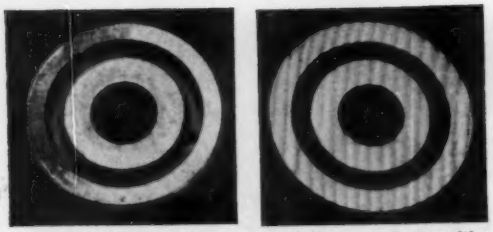
Since the plate and workpiece are both exposed to abrasive action, plates may soon be worn out of flat. Some means must be found to restore plate flatness. In our case, we have a patented method of continuous plate self-conditioning. One or more conditioning rings, overlapping the work area from the central relief to the outer periphery of the plate, do this.

These rings can do double duty by serving to hold the work. Many special holding devices are made but the simplest is a roller attachment that holds the ring in a fixed radial position but permits it, with any work it contains, to rotate as the plate turns. The combined motion comes close to meeting the ideal motion mentioned earlier. Periodically, slight readjustment is made to relocate the conditioning ring or rings.

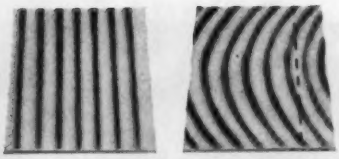
Some pressure between the workpiece and the plate is needed. The work's weight may be adequate or more pressure can be applied in a number of ways, for example, a weighted pressure plate.

On all but the smallest machine, the 10-in. model, the abrasive selected and mixed in one of our three special vehicles is automatically fed to the lapping plate. The compound is continuously agitated to insure good mixing. It is fed to the side of the conditioning ring which as it turns, distributes it evenly on the lap. The small model uses compound in paste form, manually applied.

Selection of abrasives will depend on many factors. The two materials commonly used are silicon carbide and aluminum oxide. Each material comes in different mesh sizes. In general, silicon carbides are provided in six



Flatness of surface at left is not within area of recognition of optical flats. After lapping, straight, parallel, equally-spaced lines show surface at right is perfectly flat.



Flatness interpretations. Straight, parallel and equally spaced bands (left) show surface is perfectly flat within one millionth of an inch. At right, tangent line intersects two bands showing part is two bands or 23.2 millions out of flat.

grades from 220 to 800 mesh. They are fast-cutting and are used where appreciable stock removal (in terms of lapping practice) is required and where finish is less important then flatness. The finest mesh produces 5- to 10-RMS finishes; the 220-mesh giving from 30- to 40-RMS finishes.

Aluminum oxides used range from 400 to 900-mesh sizes. This material is softer, slower cutting and produces finer finishes. For example, a 700-mesh compound is commonly used in lapping injection equipment parts. It produces a finish in the range of 3- to 5-RMS.

While impregnation of surfaces with the lapping compound does not occur, abrasive particles will sometimes be found between surfaces after assembly. The answer is inadequate cleaning. *Lapped parts must be thoroughly cleaned.* Aluminum oxide particles left on the parts will in time disintegrate and stop cutting action but the silicon carbides keep cutting as long as they are between the surfaces.

Measuring Flatness and Finish

RMS finishes have been mentioned and here's another —light bands. The first refers to a method of measuring relative smoothness of a surface; the second, to how flatness is measured.

Smoothness of a surface is measured by a laboratory-type instrument. A fine stylus is passed over the surface and it rides up and down the microscopic hills and valleys, much like the needle on a super-sensitive phonograph. It measures the deviation from a true base surface in millionths of an inch (micro-inches) in terms of root mean square (RMS). RMS finish of the base surface would be zero (no deviations) so it can be seen that a 3- to 5-RMS finish is pretty smooth.

These surface analyzers are generally found only in the laboratory. However, after checking results with various materials, different sizes and types of abrasive and varying time cycles, it is possible to predict results with good accuracy.

Measuring flatness is a different story. Direct optical measurement in the shop is entirely feasible. Flatness is expressed in terms of light bands. All that's needed is a monochromatic light and an optical flat. These items are not as formidable as they sound.

In our light, a helium-filled tube activated through a 12,000-v transformer produces a "yellowish orange" light. All other colors are eliminated. The wave length of this color is 23.2-millionths of an inch. In the measurement procedure only half the wave length or 11.6-millionths of an inch is used.

Optical flats are highly-transparent quartz discs in diameters varying up to 12 inches to suit the work size. Incidentally, their flatness is a commentary on the capability of the flat-lapping process. We lap these to an accuracy of 1.6-millionths to 2.32-millionths of an inch across their diameter.

The flat is placed on the workpiece and the light arranged to hit the surface at an angle and then be reflected to the eye. Dark bands will be seen. These show where interference is produced by reflection from the two surfaces. Interpretation of the band pattern tells the flatness.

For example, straight, parallel and equally-spaced bands show flatness within a millionth of an inch. For a lesser degree of flatness, the bands show curved patterns. One case of interpreting flatness is illustrated to show the principle. For those interested, a complete guide chart is available. The point here is that flatness measurement in millionths of an inch is a simple shop procedure.

Parts come from the lapping machine with a frosty finish. To sharpen up band patterns, the workpiece should be polished by a few light passes on special polishing paper. Very little effort is required to produce mirror finishes.

Summarizing

Today, flat-lapping has taken its place along side other machining processes. Designers are using the capabilities of the technique to solve problems of high-pressure sealing and distortionless assembly. And are doing so in an ever-increasing number of cases.

Despite the high accuracy of flatness and finish achieved, flat-lapping is not an expensive or "prima donna" technique. Our machines are found in both production lines and shops. So the designer can specify flat-lapping for manufacture with assurance that the same specification can be met later in the repair shop.

Flexibility of the process is evident. Uses range from lapping flange faces on transmission housings to lapping germanium crystals, 0.001-in. thick with perfectly parallel faces, for use in transisters. And with our patented feature of self-conditioning of the lapping plate, the machine is always ready for a production run or individual jobs wherever fast, low-cost, high-quality surface conditioning is required.

One set of spare parts serves all these 18 HERCULES engines

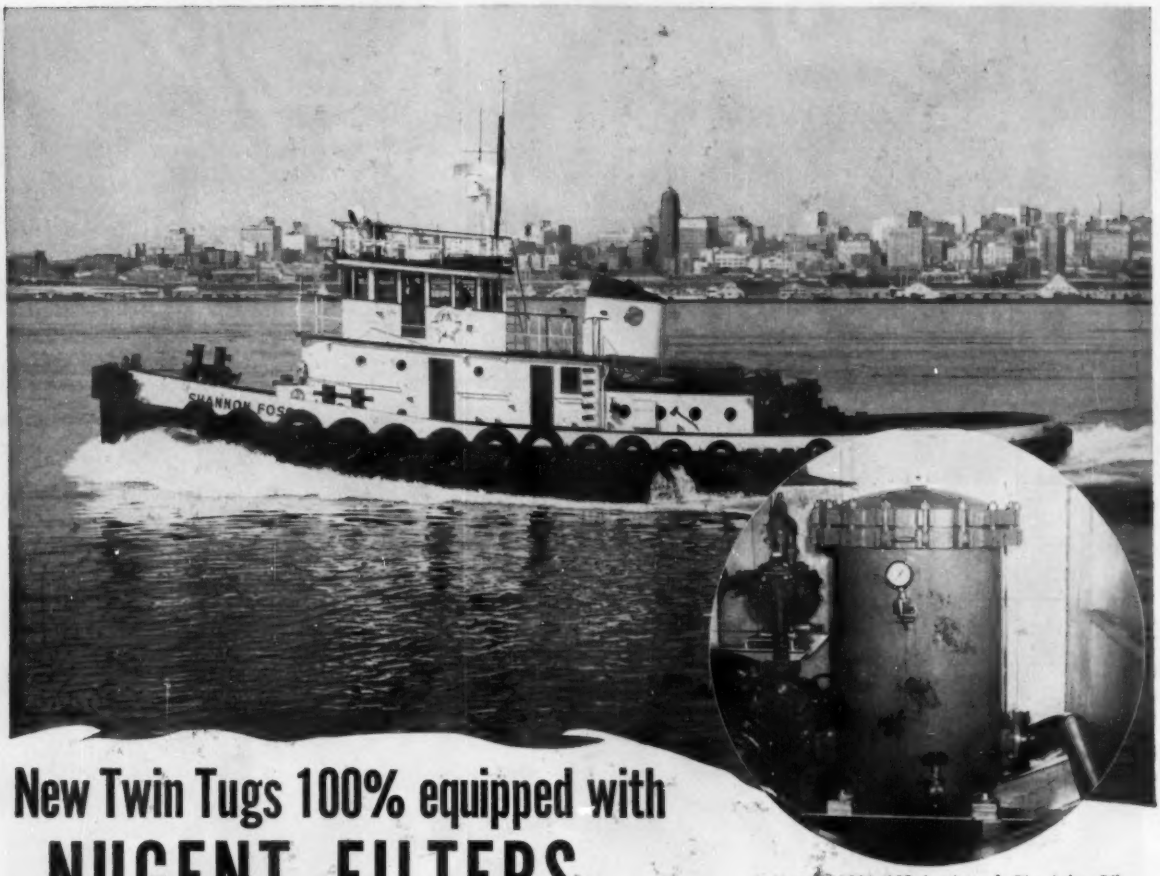
Here's parts interchangeability to warm a maintenance man's heart! Hercules designed the new DD diesel and GO gasoline engines with the user in mind: succeeded in achieving a unique degree of interchangeability that reduces spare parts requirements for Hercules-powered equipment to a minimum.

Actually, the illustration above doesn't tell the whole story. To do that, we'd have to show 6 power units as well as all 18 models of 3, 4, and 6-cylinder engines available in the DD and GO series—a total of 24 power plants using many of the same wearing parts!

You can take advantage of this maintenance economy by specifying Hercules diesel, gasoline, or LP-gas power for the equipment you buy. If you'd like the full story on these modern engines, write Hercules Motors Corp., Canton 2, Ohio—or call your Hercules distributor: there's one in the Hercules worldwide network near you.

HERCULES

HERCULES MOTORS CORPORATION
Canton, Ohio



New Twin Tugs 100% equipped with NUGENT FILTERS

A Nugent 1555-4L12 Laminated Disc Lube Oil Filter is installed on the Nordberg Diesels powering the *CAROL FOSS* and the *SHANNON FOSS*.

Nugent 1555 Duplex Filters handle both the supercharger lube oil and the fuel oil aboard the new Foss tugs.

The *CAROL FOSS* and the *SHANNON FOSS* are new twin tugs owned by The Foss Launch and Tug Company, Seattle, Washington. Each is powered by a 1400 HP Nordberg Diesel Engine.

To assure these engines long years of trouble-free, efficient filtration of lube and fuel oil, The Foss Company specified Nugent Series 1555 Laminated Fiber Disc Filters . . . 100%.

Each tug is equipped with a Nugent 1555-4L12 which filters all the lube oil in circulation every cycle before it flows to the bearings. Foreign solids as small as 2 or 3 microns are removed and oil is filtered at the rate of 290 GPM. The filter contains twelve 4L cartridges having a combined filtering surface of 37,200 square inches. Supercharger lube oil is handled by a Nugent 1555-1R duplex filter with switching valve, which allows oil to pass through either filter or both in parallel. Fuel Oil is also filtered by a Nugent Laminated Disc Filter equipped with a switching valve. Capacity of each filter comprising this duplex is 7 GPM of 35 SSU viscosity fuel oil at 3 psi pressure drop.

Filtering plays a major role in the efficient operation of an engine. If you want the best protection available, it will pay you to talk to Nugent. Top quality filters have been our business for over 60 years.

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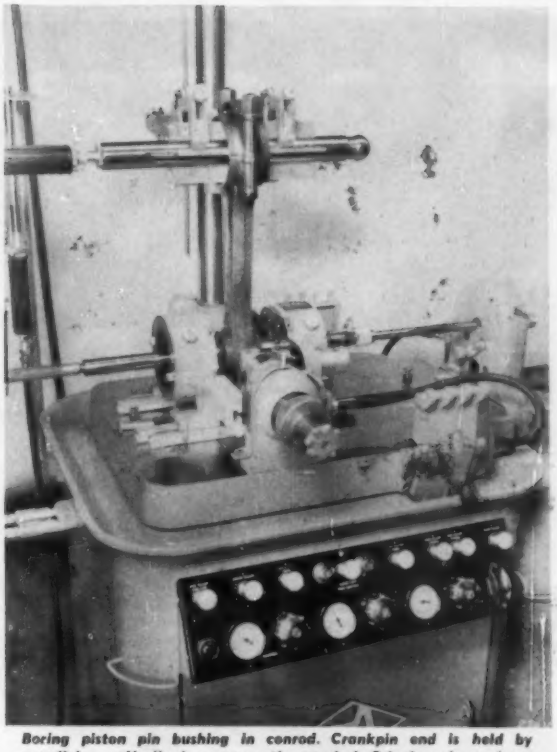
WRITE FOR BULLETIN 7C

This new bulletin illustrates and describes Nugent Laminated Fiber Disc Filters. Complete information on design, construction, specifications and capacities of standard, high pressure and duplex models.

Precision Pin Fitting Made Easy

By Arnold W. Larson
Vice President—General Manager, Tobin-Arp Mfg. Co.

Piston pin fits for modern high output engines must be exact. Specialized pin fitting machines give perfect jobs quickly and easily. Results are a long life with trouble-free operation.



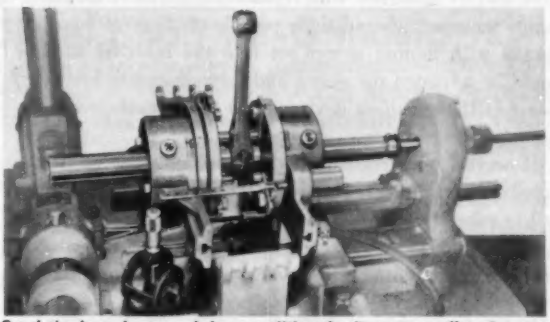
Boring piston pin bushing in conrod. Crankpin end is held by equalizing, self-aligning pneumatic mandrel. Gripping shoes clamp small end of conrod so bushing is bored exactly square and parallel to crankpin bore with specified center-to-center dimension.

TODAY's high-powered diesels make it hard on the piston pin and its bushings. All pressure on the piston is transferred through the piston pin to the connecting rod. Pin size is physically limited and so unit pressures are high. Pin motion at the pin is oscillating rather than rotary, always a difficult lubrication condition. In addition, temperatures are fairly high.

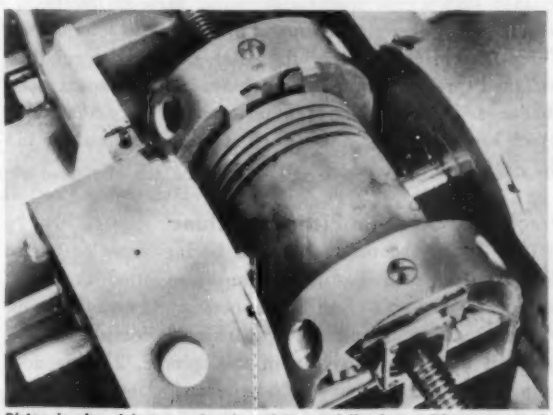
All these conditions emphasize the need for maximum contact, good surfaces and proper fit. Importance of clearances is emphasized in 4-cycle engines where the pins and bearings are subjected to load reversal. Get a little excessive clearance and it doesn't take long to pound out the bushings.

So piston pin fitting is important. The hole must be accurately sized, straight, round, uniform throughout its entire length and have an extremely fine finish.

A brief review of the methods of fitting piston pins shows that there are three different ways by which this operation has been accomplished.



Crankpin bore in conrod is reconditioned after crown diameter was reduced by milling cap and conrod shank. Comparator for setting cutter to piston pin diameter plus required clearance is in foreground.

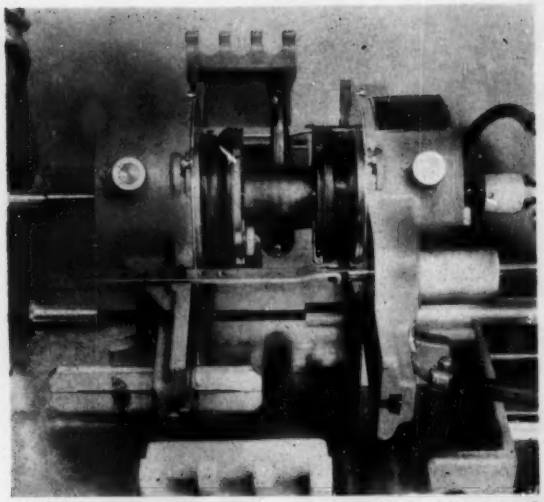


Piston is placed between bearing plates and lined up with a pneumatic mandrel. Pressure plates automatically level and clamp piston endways. Pneumatic bind clamps lock entire unit so mandrel may be removed and boring bar inserted for boring bosses for oversize pin.

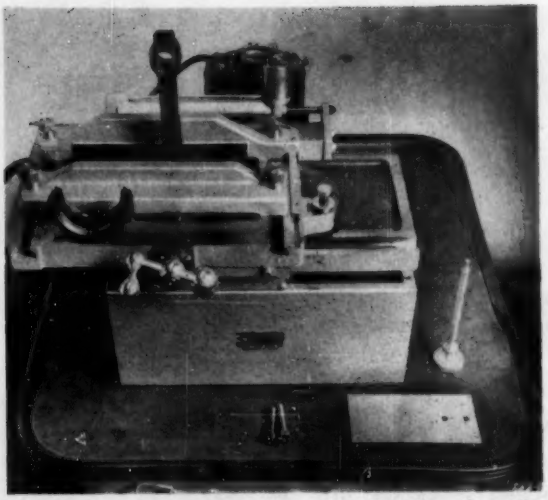
Methods of Fitting Piston Pins

The first of these methods involved the use of the reamer. The original reamers, mostly of the straight lip type, (all adjustable types had straight lips) did not produce the required finish. Minor chatter left ridges and valleys in the bushing surfaces that while acceptable in some services, were unsuitable for this one. Later, better reamers with spiral lips were developed. Chatter was reduced and smoother holes cut.

The next method to be developed for this extremely difficult operation was honing. Several manufacturers



Boring rocker arm bushing. Rocker arm is centered with pneumatic mandrel between self-aligning bearings and back-up collars, then clamped with equalizing holding device. Mandrel is then removed and boring bar is inserted. The time required for complete set-up and boring to size is less than one minute per rocker arm.



Conrod and main bearing cap miller removes material from the parting line of both shank and cap of conrod. Purpose is to reduce crown diameter before centering the conrod in the piston pin fitting machine for precision boring back to standard size. Milling unit can handle bearing cap sizes ranging from 1¾ to 10-in.

have developed hones of various types. Some of these have been merely mandrels with replaceable abrasive cloth segments wrapped around their periphery. Several were designed with honing stones set into the mandrel so they could be adjusted for sizing and to compensate for wear. Some of these honing devices have been developed to extremely fine accuracy.

However, both reamers and hones tend to "follow the hole". Even if they produced perfect holes, these techniques fail to take into consideration two important points in fitting piston pins—(a) bores at both ends of the conrod must be parallel and (b) center-to-center dimension between the bores must be maintained.

In the days of low-compression, low-speed engines, these dimensions were not nearly as critical as they are with today's high-speed, high-compression diesels. However, with the modern engine's demand for minute fit tolerances, Tobin-Arp Mfg. Co., saw the vital need for specially-designed precision boring machines and accepted the challenge. They developed a piston-pin fitting machine which has established a very high standard of accuracy in the engine rebuilding industry.

Precision Piston-Pin Fitting Machine

This Tobin-Arp machine has a boring capacity from 21/32-in. to 4⅛-in. Equipment can be supplied on it for holding pistons up to 8-in. in diameter and conrods from 3⅝-in. to 23-in. in length. The machine is completely air operated except for driving of the spindle. This is accomplished with a standard ½-hp electric motor. Centering devices are pneumatic mandrels. Holding is accomplished with equalizing, self-aligning, air-operated clamping devices. Nothing in the operation of the machine requires the operator to use hand tools of any kind. All is accomplished with air valve buttons on the machine panel or on the handle of the mandrel.

The unit is equipped with a comparator for setting the cutter. The cutting tool is set by specific comparison with the particular pin to fit the hole. This cuts the pin's exact diameter plus the desired clearance. The cut can be controlled to a fraction of a ten-thousandth of an inch. This enables the operator to make an absolutely controlled cut on his first set up. It has removed entirely from the piston-pin fitting operation, the "work-and-try" element of fitting with honing or reaming equipment.

Furthermore, the machine is designed with a vernier scale on an upright column. This permits the operator to set to a predetermined or specified dimension and thereby bore all conrods for an engine to the exact specified center-to-center dimensions. At the same time, the bore at either end of the conrod can be bored absolutely parallel with the end from which the conrod is being held.

The finish which can be accomplished on this operation has been checked out at less than ten micro-inches. However, finish depends largely upon the type of material as well as the grade of cutter used. In boring bronze bushings where the material lends itself to the finest possible finish, the machine has turned out finishes between four and six micro-inches.

Precision fit is a matter of machine accuracy and rigidity. The boring bar is supported in a way that allows it freedom of rotation—yet holds it firmly against whip. To obtain the accuracy and rigidity to get such surface finishes, Tobin-Arp designed their own bearings for this machine.

(Continued on Page 36)

NEW!

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1 A great, new Heavy Duty Grinder, at a sensationally new low cost, with the range to re-grind Diesel Shafts up to 84" long... a 22" swing over centers. A range not previously encompassed, except by larger or much more costly machines! Constant alignment, vibrationless operation, greatly reduced set-up time.

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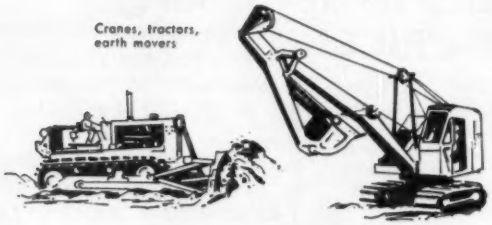
New! Quick Starting Aid for STARTING DIESELS

IN ANY WEATHER

TURNER QUICK-START



Pull the Quick-Start choke, on the dash, for a couple of seconds, hit the starter and your Diesel is running. Simple to install, easy to operate, Quick-Start is a mixture of ether and petroleum products under pressure in a closed system.

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(Continued from Page 34)

Since there are three different sizes of boring bars—5/8-in., 1-in. and 1½-in.—the machine must also be equipped with three different sizes of bearings. The 5/8-in. and the 1-in. bearings are double-row, self-aligning, preloaded, sealed, super-precision ball bearings with a maximum eccentricity of 25 millionths of an inch. The 1½-in. bearings are made with oilite shoes mounted in a cast iron cage. With 1½-in. bearings there is occasionally simple adjustment necessary to maintain the 0.00015-in. clearance between the hard chrome-plated steel boring bar and the bearing surface.

This machine has placed the job of piston-pin fitting on a very high plane. It has made it a clean, attractive operation and also one which can be accomplished without many years of experience on the part of the operator.

Other Uses of Piston-Pin Fitting Machine

In addition to the boring of piston bosses and conrod bushings, other rod reconditioning jobs can be done. It can also be easily adapted to boring of rocker arm bushings and cam followers.

Tobin-Arp is constantly striving to revise the machine and find additional precision boring operations that can be accomplished by its users. Within the last 12 months they have designed and placed on the market an attachment for the pin fitting unit for reconditioning the crank pin end of the conrod. As a companion item, they have also provided a small milling machine for removing material from the parting line of both the shank and cap of the conrod. The purpose is to reduce the crown diameter before centering the rod in the piston pin fitting machine for precision boring back to standard.

The machine is also equipped with a high-speed, diamond-disc, tungsten carbide tool grinder. This makes it possible to grind all cutters for the unit to the exact specified angles. This unit has recently become a standard item in the tool catalog of one of the largest diesel engine manufacturers in the world.

These refinements can be added even to the earliest models to leave the plant. Tobin-Arp is constantly on the lookout for additional uses for the machine. As additional uses are discovered, equipment will be developed for their accomplishment. Whenever it is mechanically possible, all these developments will be made in such a way as to incorporate them into every machine in the field.

Conclusion

Proper clearances; holes that are straight and round for their entire length; fine surface finish; parallelness of both conrod bores; accurate center-to-center distance;—all these exacting requirements of proper pin fitting are being met in service shops every day. Use of specially-designed machines with extremely high standards of accuracy not only make this possible but do a difficult job easily and quickly.

The Piston with "Double Bonded" "Ni-Resist Iron" Top Ring Section STOPS! RING GROOVE WEAR!

BOND E LOC*

Exclusively DOUBLE BONDED
METALLURGICALLY Al-Fin Process
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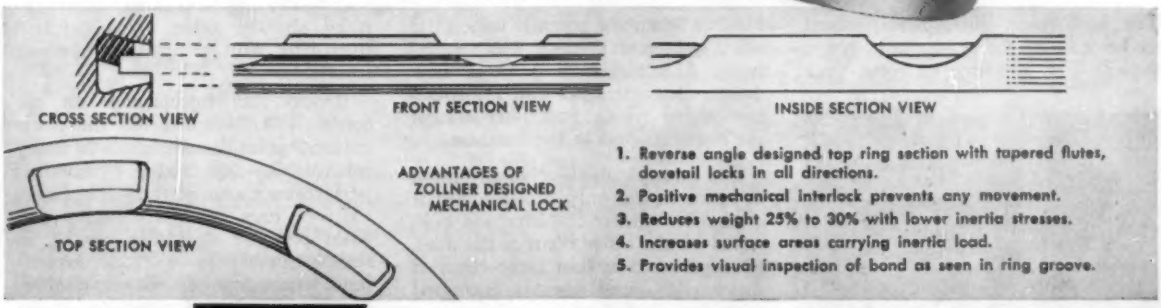
Keeps Engines Powerful Longer — at Lowest Cost

"A sensational development — the greatest mileage piston we have ever used." Everywhere, engine builders and transport operators enthuse over the performance of Zollner Bond-O-Loc Pistons. Top ring groove wear problems are eliminated by the "Ni-resist" Iron section *permanently* incorporated with the double bond of *both* A1-Fin metallurgic *and the exclusive* Zollner mechanical lock. Separation failure is impossible. For longer piston life and lower maintenance cost, we suggest your immediate test of Bond-O-Loc advantages.

*T.M. Reg. Pat. App. For


CROSS SECTION VIEW
FRONT SECTION VIEW
INSIDE SECTION VIEW
TOP SECTION VIEW
ADVANTAGES OF ZOLLNER DESIGNED MECHANICAL LOCK
1. Reverse angle designed top ring section with tapered flutes, dovetail locks in all directions.
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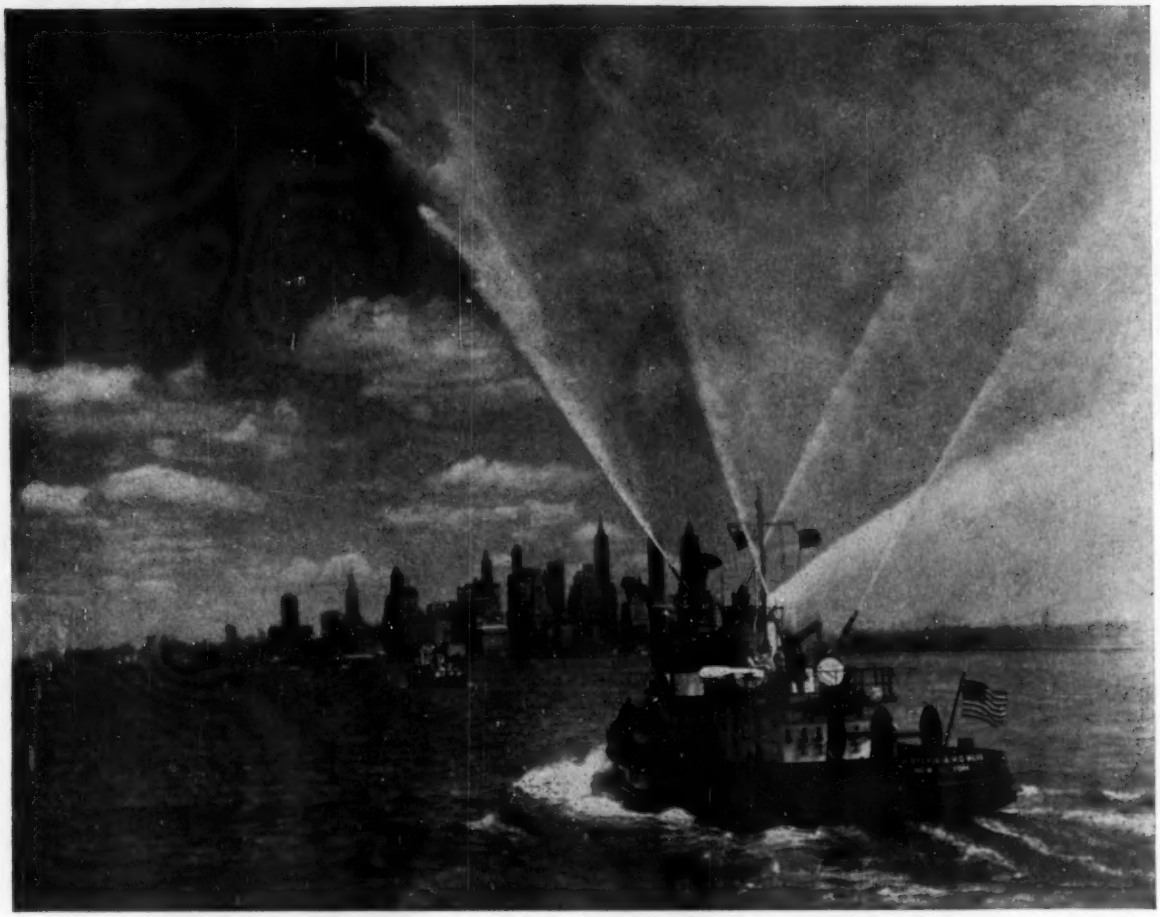
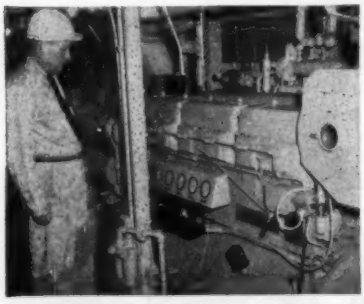


SYLVIA WILKS GETS A NEW YORK WELCOME!

The new *Sylvia Wilks*, first fireboat to be named for a woman, got a typical VIP welcome in New York Harbor when she recently joined the world's largest floating fire department. She embodies a lot of new design characteristics and improved equipment which make her one of the best fireboats in the business.



Lt. John Collins, supervising engineer, Marine Division, New York Fire Department, checks on one of the four Enterprise diesel engines with Bendix fuel injection which power the *Sylvia Wilks*.

For example she is relatively small as fireboats go, only 105 feet. But it gives her maneuverability not possessed by the other boats of the fleet. She's powered by four turbo-charged Enterprise diesel engines equipped with Bendix® fuel injection—two each for propulsion and pumping. This setup gives the boat full pumping power at all times in contrast to many fireboats that have pumping mechanisms taking their power from the propulsion engines, leaving the vessel handicapped for speed if the need should arise for both full pumping and propulsion power simultaneously.

Bendix fuel injection is on the *Sylvia Wilks'* engines for the same reason it is on diesel engines in many other fields—dependable, economical performance around the clock. Locomotives, tugs, towboats, and petroleum pipeline operators use it; in remote spots such as Thule, Greenland, where dependability is priceless, Bendix diesel fuel injection is on electric power generating engines.

For more information about this quality equipment, please write our Scintilla Division of Bendix Aviation Corporation, Sidney, N. Y.

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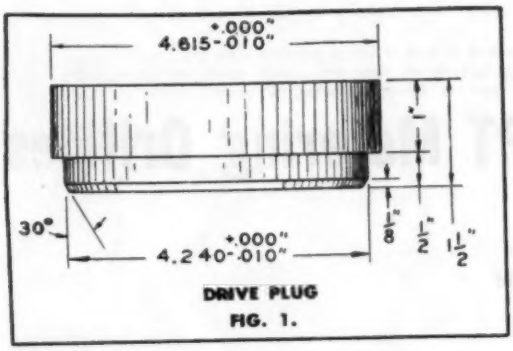
Bendix
AVIATION CORPORATION



DRIVE PLUG
FIG. 1.

Small end of solid steel drive plug shown in Fig 1 is inserted into lower end of liner. Hardwood block is then held against plug and hit with heavy hammer. (Fig 2) until liner is free.

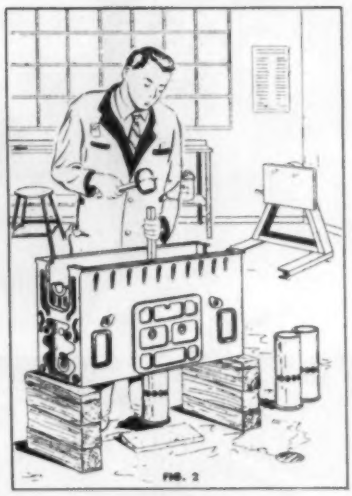


FIG. 2

Servicing Liners In Aluminum GM Blocks

Step-by-step procedures for removing, checking and installing liners in GM's Series 71 diesels with aluminum blocks.

REMOVING and installing liners in an aluminum block can be easy—if the right method is used. Here is a procedure suggested by the Detroit Diesel Div. of GM for use on their Series 71 engines with aluminum blocks.

Liner Removal Procedure

Due to the close fit between liner and cylinder block in the "71" engine, (0.001-in. loose to 0.001-in. press), a drive plug made from solid steel, as detailed in Fig 1, will facilitate removal of liners.

These steps are suggested for liner removal.

1. Immerse stripped cylinder block in a tank of hot water (180°F) for about 20 minutes.
2. Lift block from hot water and place it upside down on wood blocks as shown in Fig 2.
3. Insert small end of drive plug into lower end of liner.
4. Hold one end of a hardwood block against end of drive plug, and drive block with a heavy hammer until liner is free. Remove all liners the same way.
5. Remove cylinder liner inserts.

Liner Installation Procedure

Before installing liners, the block should be checked and thoroughly cleaned. Since most of the engine cooling is accomplished by heat transfer through the liners to the water jacket, good liner-to-block contact must exist. Liner bores in the block, including the counter-bores in which the liner inserts fit, must be clean and free of nicks and burrs throughout their entire length.

Liner bores in the block must also be checked to determine if standard size liners can be used. If a standard liner can't be used, the block must be rebored and one of the available oversize liners installed. The block bore dimension for standard size liners should be 4.6255-in. plus or minus 0.0005-in. If it is necessary to use oversize liners, use the block boring dimensions given in Table I to provide proper fit.

The 0.001-in. loose to 0.001-in. press fit between liner and block must be maintained when fitting either standard or oversize liners.

These steps are suggested for liner installation.

1. Chill all liners for two hours or more using dry ice if available.
2. Immerse cylinder block in a tank of hot water (180°F) for about 20 minutes. This should be done during the last 20 minutes of liner chilling time.
3. Remove cylinder block from hot water and place it right side up on wood blocks.
4. Place liner inserts into their counterbores in block. Use correct inserts if oversize liners are used.
5. Install liners in block bores. If necessary, carefully tap liners into place using same tools and methods used for removal. Each liner flange must bear solidly against its block insert.

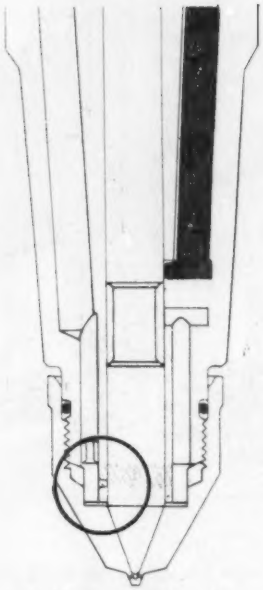
When in place, the top face of each liner upper flange should be from 0.046-in. to 0.050-in. below the top surface of the cylinder block.

If oversize liners are installed, it is suggested that the size be steel-stamped into the top deck of the block adjacent to each liner counterbore. This will assist service personnel in future engine overhaul.

TABLE I

Cylinder Block Bores For Oversize Liners

Liner Diameter (outside)	Block Boring Dimensions
0.005-in. oversize	4.6205-in. ±0.0005-in.
0.010-in oversize	4.6355-in. ±0.0005-in.
0.020-in. oversize	4.6455-in. ±0.0005-in.
0.030-in. oversize	4.6555-in. ±0.0005-in.



Circle shows metering orifice in Cummins PT fuel injector.

Restoring PT Metering Orifices

By Kenneth R. MacDonald

Cummins PT injectors with eroded or damaged metering orifices are salvaged by a re-orificing technique. At same time, new plunger is fitted if needed. Result—new-injector performance at substantial cost saving.

CUMMINS PT system injectors with worn metering orifices can be salvaged. A unique new facility to restore these fuel injectors to factory specification standards has been created by Cummins Service & Sales, Los Angeles. The new program includes re-orificing of metering orifices as well as honing of worn bodies and installation of new plungers.

To keep costs at a minimum, this Los Angeles firm has installed its own micromatic honing machine as well as gauges and other precision tools required to rehabilitate injector bodies. Procedures and tolerances adopted have been approved by the Cummins Engine Co. They follow exactly those which are used in new injector production.

An injector rehabilitation department and a new turbocharger rebuilding department have been set up by Cummins Service & Sales in its branch operation at Montebello, Calif. Here, a modern structure has been specifically designed as a diesel engine center. George Hedstrom, Montebello branch manager, is now also in charge of the new departments.

It was in an interview with Hedstrom that complete details of their injector rehabilitation program were obtained. This program includes rebuilding of injectors for all Cummins diesels except the Model L engines. Customers are guaranteed shipment of exchange injectors within 48 hours after old cores are received. To accomplish this, over 3000 injector bodies were first rehabilitated for stock.

Cummins engine owners can get the Cummins Service & Sales exchange bodies and plungers for 22% of the cost of new ones, or 31% of new injector cost if re-orificing is needed. This means savings of from $124 to $372 per engine overhauled, depending on whether the engine has 4, 6, or 12 cylinders.

Injector Rehabilitation

In addition to plunger bore wear, erosion is often found in and around the metering orifices and both types of wear, when severe, call for injector rehabilitation or replacement.

Injector rehabilitation procedures at the new Montebello department involve careful inspection of cores submitted for exchange. Any which are found to be cracked, mutilated, or already honed to maximum oversize, are rejected.

Before the inside of the body is honed, an injector cup is attached temporarily at proper torque. According to Hedstrom, the cup keeps the injector body nose from distorting while being honed. A specially trained machinist then brings the body to the nearest oversize on the micromatic honing machine. During honing and final inspection, bore size and straightness are checked to factory tolerances on a Sheffield air gauge mounted on the micromatic honing machine.

Injectors for the PT fuel system are given an aluminum oxide vapor blast to remove any burrs or metal particles that may have been deposited in the orifice during honing.

Finished bodies are then fitted with new Cummins oversize plunger assemblies. Each undergoes a careful inspection to assure proper performance. Metering orifices in PT bodies are flow-checked to make certain that all injectors deliver the same amount of fuel.

Fan-shaped area extending from metering orifice to face of body shows wear pattern magnified many times. This wear makes honing and replungering necessary. Erosion in metering orifice is also seen.

Unretouched photo shows extreme erosion in metering orifice. Use of strong magnifying glass will show if orifice is eroded.

Magnified view from inlet side shows new orifice installed.

Magnified view shows metering orifice after it has been blasted with abrasives to remove the burr caused by honing.

Re-orficing

The Cummins Engine Co. has never re-orificed injector bodies although it has been done commercially by at least one independent west-coast firm for some time. Cummins discards those injector bodies which show erosion in the orifice.

"In spite of this factory practice," Hedstrom says, "the company was aware of the savings which could be passed on to engine owners and therefore gave full approval to procedures and results of the Cummins Service & Sales program." These savings really add up, according to Hedstrom, when you consider that about 10% of the PT injector bodies are found to be eroded in and around the metering orifices. In addition, he says that many owners request changes in the size of metering orifices.

To detect erosion in the metering orifices, a strong magnifying glass is used. Inspections in the shop are made with a powerful light and under a 30-power microscope. The photos of orifices shown, were taken with 20 magnification.

Re-orificing calls for drilling and reaming of the original orifice to 0.090-in. diameter. The inlet side is counterbored to a 0.010-in. depth. A headed plug of the same SAE steel specifications and hardness as the injector body is pressed into the hole with a slight taper fit. The plugged body is then put into a drilling fixture designed to hold the body such that the orifice is drilled 0.095-0.097-in. from the body's nose. Speed of drill used is 7000 rpm.

Length of the sized metering orifice is held to 0.015-in., (plus 0.010-in., minus 0.000-in.), with an approach hole as specified by the Cummins Engine Co. Extension of the plug on the inside of the injector bore is removed with a specially-designed cutting tool. From this point on, the body is honed, vapor blasted and the orifice flow checked, the same as bodies that are re-plungered only.

Conclusion

This re-orificing work actually approaches the fine craftsmanship of watchmaking, in terms of precision. Visitors to the new department are impressed at the minute size of plugs and drills used. Engine owners are even more impressed by the money they save through this process of rehabilitation of injectors which formerly had to be thrown away.

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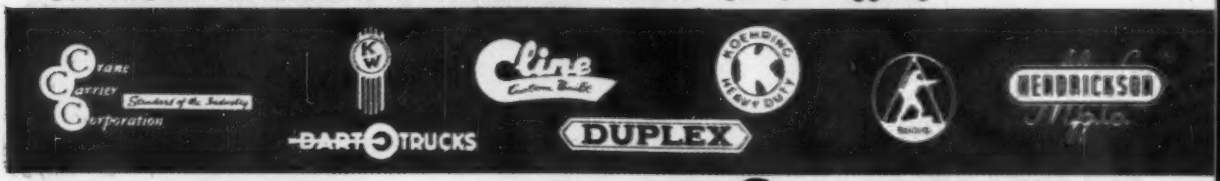

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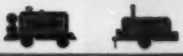

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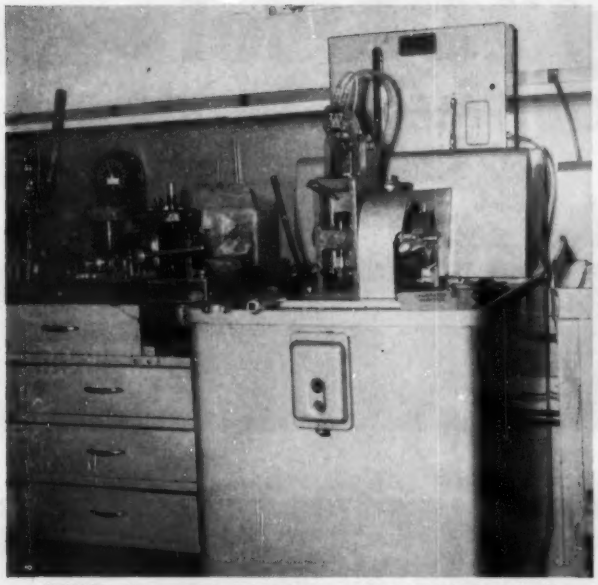
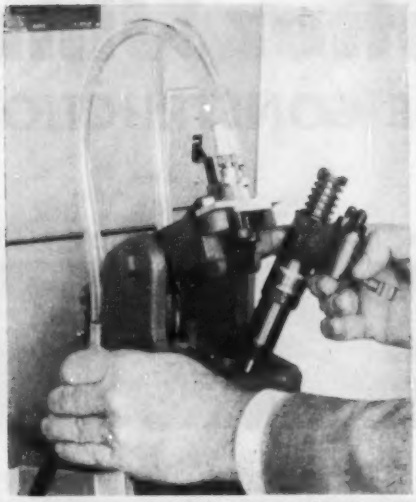


U-8000F, floor model GM injector calibrator with heated oil supply tank simulates actual engine operating conditions closely. Standard GM cam and rocker arm gives injector plunger acceleration and delivery characteristics matching those of engine.



U-8000, table model GM injector calibrator with cam and rocker assembly tilted back by lever at left permits easy mounting of Series 71 engine injector.

Calibrating and Running-In Unit Injectors

By S. E. Franklin
Diesel Controls, Inc.

Sets of injectors with matched delivery improve the engine's power output and general performance. Run-in, simulating engine conditions as far as possible, proves that the injector is ready for work. A new comparative calibrator provides means for attaining both of these important advantages.

HIGHER percentages of power are being demanded of modern engines. As far as injection equipment is concerned, this makes it more critical that fuel distribution to all cylinders be equal.

In systems with separate pumps and injectors, service equipment and methods have been worked out together and have been pretty well perfected. Pumps are calibrated at different points in their operating range against master injectors. Injectors are put through all the normal tests and then may be flow-tested for assembly into matched sets.

Yet with unit injectors of the type used in General Motors diesels, a hand method of testing is commonly used. While this provides a check on spray pattern, opening pressure and some leak-off data, there is no check of delivered quantity. Reliance is placed on the accuracy of manufacture and while this may be fine for original application, it leaves something to be desired for injectors that have been in use.

As manufacturers of service equipment, we thought that something could be done to improve this situation. The result was development of comparative calibrators for the unit injectors built by General Motors.

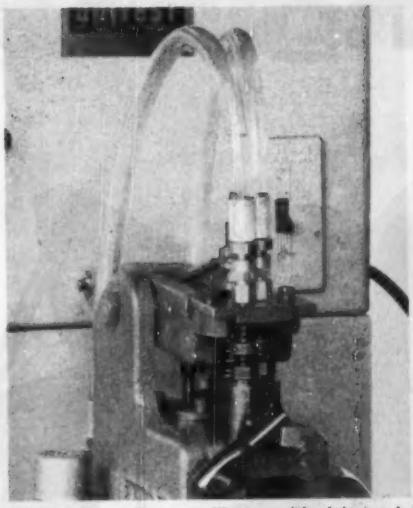
Why Calibration?

The purpose of calibration is to insure that the injection equipment meets certain performance specifications. One requirement is ability to deliver equal amounts of fuel to each cylinder throughout the engine's performance range. Where adjustment is possible as in the case of, say, multi-plunger pumps, compensation for variations, within practical limits, can be made and performance set to meet standard calibration data.

In General Motors unit injectors, no adjustment is provided for calibration prior to installation. Thus, any attempt to balance fuel delivery among injectors must be on a comparative basis. Delivery characteristics of each injector is checked.

Two courses are open. If performance varies but is within acceptable limits, injectors may be grouped in sets of those having similar delivery characteristics. Or service procedures can be adjusted, using all new parts necessary, to bring all the injectors' outputs within narrow limits.

This ability to calibrate injectors has several advantages. It gives a far better picture of injector condition than hand bench methods when units are removed



U-8000, GM injector calibrator with injector installed and ready for operation. Note flexible tubing for inlet and by-passed fuel to and from injector.

U-8500, injector calibrator for Model 567 GM diesel engine unit injectors has speed range from 250 to 900 rpm. Injector is being removed after being tested and run-in.

from the engine for testing. If work is indicated, it gives some idea of what to look for.

When the injector is being reworked, visual inspection is commonly used to determine whether the used parts are satisfactory for continued use. Dynamic quantitative calibration eliminates guesswork and tells positively whether the part is satisfactory. A lot of parts will fool you. Some will look good and perform poorly; others that you'd normally throw away can be saved.

In shops where a lot of injectors are being reworked, a routine is often established. Here, the machine becomes a "go" or "no-go" gauge; a foreman can check the work of his men. Volumetric checks on delivery gauge the correctness of the methods used and quality of the work. It shows that the proper parts were used and assembled correctly.

An Injector's "Dynamometer"

Experienced maintenance men will tell you that if a rebuilt engine or component is going to fail, it will usually do so right after being put back in service. Once it gets over the hump of this critical period, it settles down for a long, useful life. Experience with injectors is no different.

This "running-in" period for an engine is preferably performed on a dynamometer. It gives the parts a chance to mate and "settle down" under controlled conditions; errors, leakage, etc. are caught; chances of piston scuffing or seizure are eliminated; and performance is measured. This exactly parallels what can be done on the injector calibrator even to the advantages obtained.

To insure that injectors are ready for good combustion on initial engine start, the calibrator was built to simulate actual engine conditions as closely as possible. For example, when the injector is installed in the machine the plunger spring is automatically compressed to the proper timing position. Then with standard GM cams and rockers arms (Model U-8000 uses those for Series 71 engines; Model U-8500 for Model 567 engines) plunger acceleration and delivery characteristics match those of the engine. A heavy flywheel insures steady rate of plunger travel.

Calibrating oil at controlled temperature is supplied to the injector at a constant pressure. Operating speeds range from 250 to 900 rpm for the larger unit; tests and run-in on the smaller one are run at 1200 rpm. Rack settings are made and tests started. A stroke counter regulates the exact number of injections discharged to the graduate. Dumping of the graduate is controlled so that the residue from "wet glass" will remain constant.

In this way, two things are achieved—engine operation is simulated as closely as possible and since we are calibrating on a comparative basis, conditions are held constant with as many variables as possible eliminated.

Summary

Ability to calibrate unit injectors adds a new dimension to the servicing and testing techniques for this type of injection equipment. Qualitative and quantitative tests eliminate guesswork. They show that the injector is properly assembled, all the parts are in satisfactory condition, and they measure the unit's performance.

In terms of engine operation, this means that better engine balance can be obtained, resulting in higher horsepower potential and improved overall performance.

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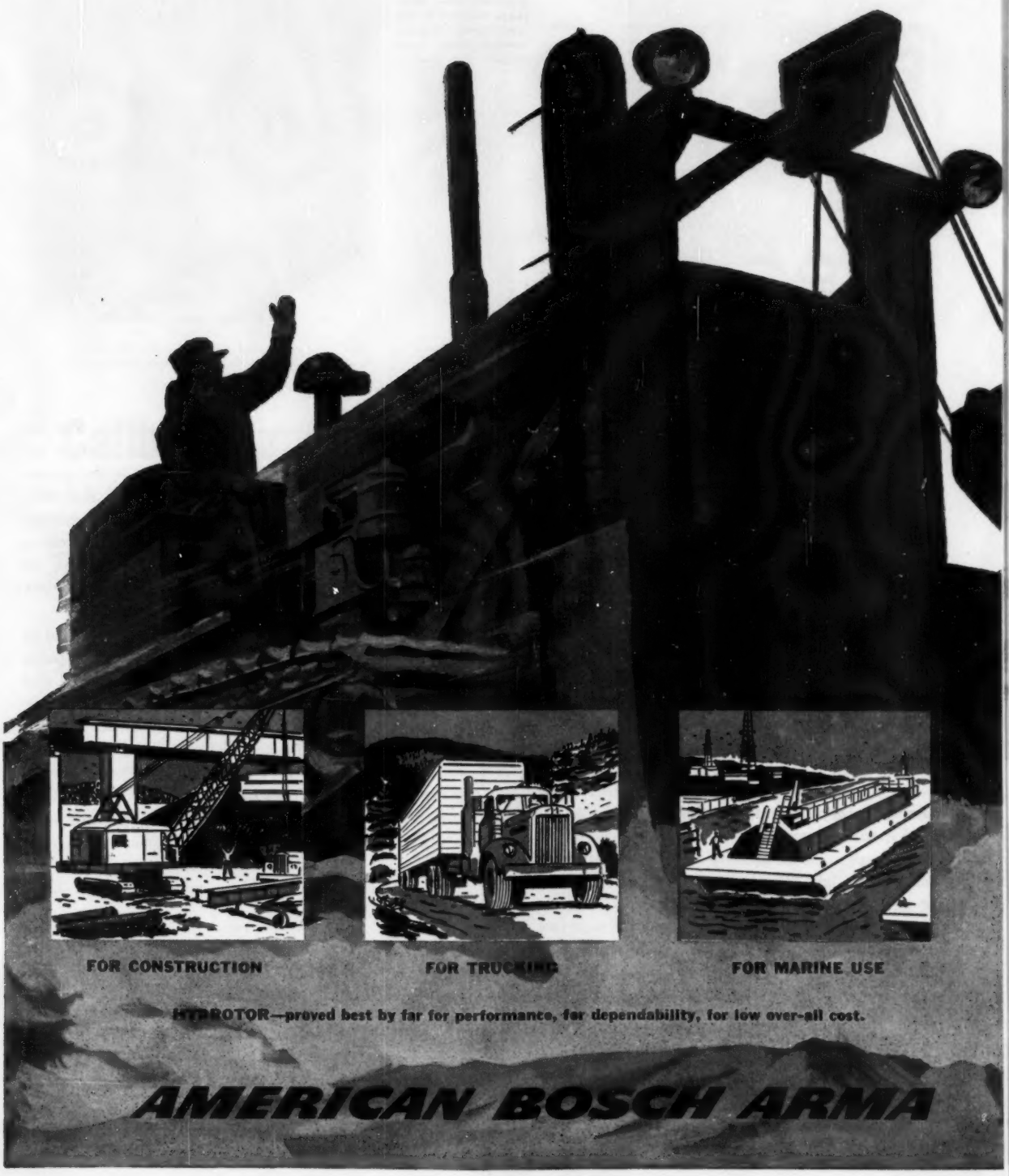

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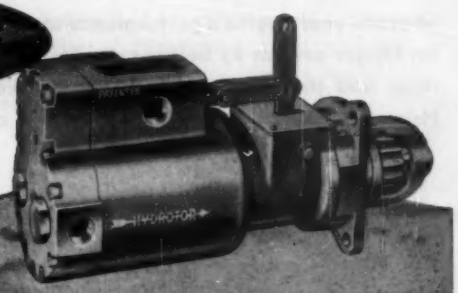

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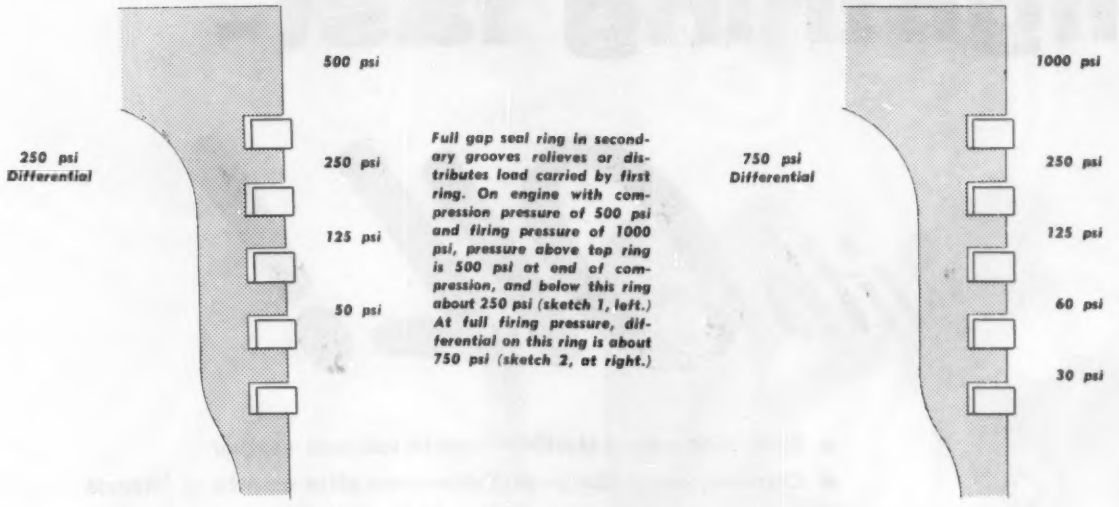


Full gap seal ring in secondary grooves relieves or distributes load carried by first ring. On engine with compression pressure of 500 psi and firing pressure of 1000 psi, pressure above top ring is 500 psi at end of compression, and below this ring about 250 psi (sketch 1, left.) At full firing pressure, differential on this ring is about 750 psi (sketch 2, at right.)

Improve Your Piston Ring Performance

By C. J. Kremer, Jr.,
Chief Engineer, C. Lee Cook Company

Improve your engine's performance and keep it high for longer periods by better cylinder sealing. Piston rings and their related parts are the key factors. Here are constructive ideas that you can apply.

A PISTON ring leads a miserable life. It is subjected to heavy individual loading, extreme heat, dirty conditions, and under the best of circumstances, to border-line lubrication. Yet it does its job—and well.

A lot of engineering has gone into this appearingly simple piece of metal. Engine designers as well as lubrication engineers have done a lot to improve its conditions of servitude. The engine comes from the factory with proper dimensions and tolerances. Chances are that it is all broken in and the piston rings properly seated.

Then comes the first inspection or overhaul period. What happens when all conditions are no longer ideal will depend on the judgement and skill of those responsible for the work. Obviously, it pays to know as much as possible about the subject.

Anything that can be done to help piston rings do their job better can be very rewarding. You'll get longer service life of rings, pistons and liners. Also, you'll get higher average efficiency—greater power output and lower lube oil consumption.

Ideas to be expressed apply in general to all piston rings but are specific to those of engines in the medium and large bore sizes.

Reuse or Replace?

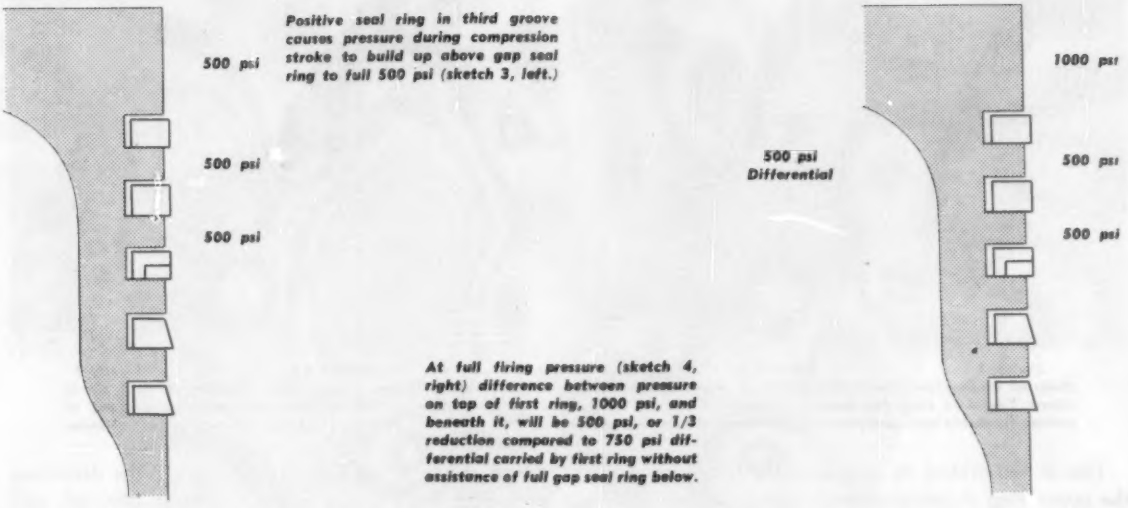
When a cylinder is opened, one of the first decisions to make is whether rings are to be reused or replaced. Of course, a lot will depend on what you find. Let's say that this is a scheduled inspection. At this time, some of the more serious reasons for ring replacement may not have yet come into play.

Conditions being generally satisfactory, a practical guide as to need for replacement is the gap clearance. It is good practice to replace rings whenever the original recommended gap clearance has doubled due to wear. However, this general guide should be modified to suit the particular type of engine.

For example, the higher the specific output of the engine, the lower the amount of ring wear that can be tolerated. In a turbocharged engine running at high bmep, for instance, accelerated movement of hot gases through enlarged ring gaps has a searing action that destroys lubricating films and also has an erroding effect on polished contact surfaces.

Continued use of a worn ring results in accelerated wear of the ring itself and, more important, of the cylinder or liner. For this reason, and lacking the specific manufacturer's wear limits, wear of only 50% of original gap clearance might be the condemning limit.

Where chrome-plated rings are involved, the percentage might be much less. Basically, the allowable limit for wear on the ring face is the thickness of the plating. Well-seated rings might be satisfactory if left undisturb-


Positive seal ring in third groove causes pressure during compression stroke to build up above gap seal ring to full 500 psi (sketch 3, left.)
500 psi
500 psi
500 psi
At full firing pressure (sketch 4, right) difference between pressure on top of first ring, 1000 psi, and beneath it, will be 500 psi, or 1/3 reduction compared to 750 psi differential carried by first ring without assistance of full gap seal ring below.
500 psi Differential
1000 psi
500 psi
500 psi

ed, even though worn through the plating. But once disturbed, replacement is recommended.

If it has been decided to reuse the rings, certain practices should be followed. Every precaution should be taken to avoid distortion or "springing" of the rings during removal or re-installation. Ring grooves should be cleaned thoroughly to their full depth. Recesses and oil return holes should be cleaned too. Finally, it is recommended practice to install the ring in the same groove from which it came—and right side up. It is assumed, of course, that all clearances were satisfactory and that this was one factor used in arriving at a decision to reuse the rings.

After long wear or when damage has occurred there is no need for a decision. Broken rings or stuck rings that have been forced against the liner and worn out-of-round are typical cases. Worn ring grooves in the piston and scuffed or scored liners are conditions that are bound to affect the rings and call for their replacement—*after the conditions have been corrected.*

Piston rings can never be considered alone. They must get proper support from the ring grooves and have proper clearances. They must contact a suitable liner surface all around their periphery. This surface must be adequately lubricated and one job handled by the whole ring setup is control of this lubrication.

So ring groove, liner condition and the situation with regards to lubrication must be considered. They will all affect the decision to (a) reuse or replace rings and (b), if replacement is indicated, whether or not a different ring setup should be used.

Choosing A Ring Setup

As wear progresses toward condemning limits, use of different ring types may be indicated. Lube oil control is a good example. It is pretty generally known that inadequate oil will result in extreme wear and tend toward scuffing conditions. It is not as well realized that excessive oil can produce the same effects.

Too much oil is indicated by correspondingly excessive carbonizing and fouling of the rings. It is this added dirt load that causes the trouble. Ring action becomes sluggish and ring flutter and sticking results. Breakage, liner wear and scuffing are direct possibilities.

Need for oil control rings with more efficient scraping action is sometimes a little involved. How much more effective they can be without starving the rest of the ring area is largely determined by experience. Due to the number of oil ring designs, each to serve an individual condition, it is best to get the help of a ring manufacturer's representative. Add his experience to your own.

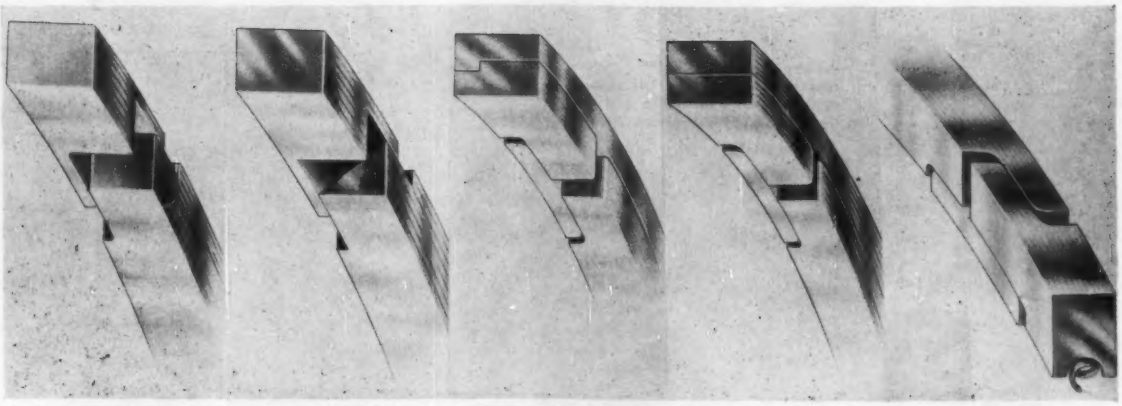
Changes in types of compression rings may also be advisable. For worn or perhaps slightly out-of-round cylinders, complete gap seal-type rings are a first consideration. Liner wear is rarely uniform over the entire ring travel area.

Gaps in conventional rings must be set to the unworn part of the liner to provide proper clearance when in that part of their travel. As soon as the ring moves into the liner's worn area, the gap is immediately increased and, since greatest wear occurs near the upper end of ring sweep, sealing is least effective just where it is needed most.

Use of a gap seal ring which is not subject in its sealing function to variations in cylinder diameter will provide the same efficiency at all points of its travel. Blowby and power loss are thus prevented.

How Gap Seal Rings Help Relieve Top Ring Load

Use of a full seal ring in modern engines cannot be overemphasized. Actual checks show that the top ring will carry from at least 50% (low-speed, low-bmep engines) to possibly 80% (high-speed, high-bmep engines) of the entire load of piston sealing.



Sketch 5 Sketch 5A Sketch 6 Sketch 6A Sketch 7

Rings of single-piece construction having a step-type gap seal as seen in sketches 5 and 5A are least effective of those shown above. Two-piece rings like those in sketches 6 and 6A give additional advantages of full cylinder and land seal because of greater flexibility and conformability. Spring-actuated conformable ring (sketch 7) gives immediate seating, also follows wavy cylinder.

This is self-evident to any operator who knows that the upper ring shows most wear and is subject also to most of the operational hazards. Piston groove wear, groove damage, ring breakage and such kindred items take place notably in the top ring groove. With engines of increased speed and power output, this problem grows more important. Anything that can be done to relieve the upper rings of at least part of the load is of primary concern.

Experiments have proven that with normal end gaps and conventional piston rings, pressure behind the top ring, holding it against the cylinder wall and against its lower groove land, corresponds almost exactly with cylinder pressure. Pressure between the first and second rings and behind the second ring amounts to about half of that figure and so on in like proportion throughout the ring belt.

This, of course, will vary with the pressure differentials involved and also with engine speed. However, we will take the highest figure which means that pressure below the top ring will be about half that above the ring. Lower figures will justify the earlier statement that the differential can be from 80% to 50%. It is this pressure differential above and below the ring that induces most wear and all attending destructive possibilities.

To show how a full gap seal ring placed in secondary grooves can relieve or distribute the load carried by the first ring, let us assume an engine with the compression pressure of 500 psi and a firing pressure of 1000 psi. Near the top of the compression stroke, just before firing, pressure above the ring will be 500 psi and pressure immediately below the ring about half that or 250 psi. At full firing pressure, therefore, the differential on this ring will be in the neighborhood of 750 psi. This condition is shown in sketches 1 and 2.

If, however, we include in the compression ring group a positive seal ring, say in the third groove, pressure during the compression stroke will build up above the gap seal ring to the full 500-psi compression pressure, as illustrated in sketch 3.

Now at full firing pressure (sketch 4) the difference between pressure on top of the first ring, 1000 psi, and the pressure beneath the top ring will be 500 psi or a one-third reduction compared to the 750 psi differential carried by the first ring without assistance of a full gap seal ring below.

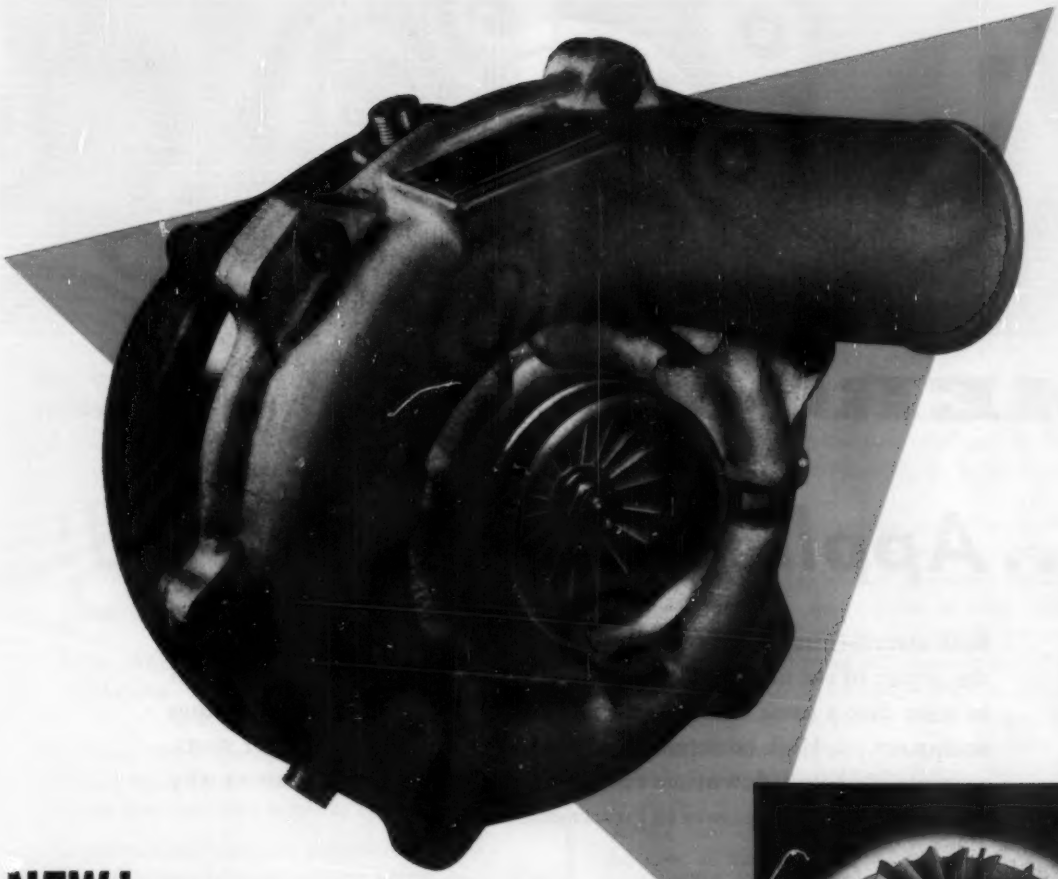
In this way, some work normally done by the top ring can be effectively transferred downward to other rings where there is better lubrication and less heat exposure. For best overall service, seal ring should be placed in the third groove. If used in a lower groove, proper seating may become a problem since pressures above and behind the seal ring will be comparatively low. Full functioning may not be possible without a prolonged running period. When the gap seal ring reaches its maximum sealing, due to satisfactory seating, load on the two hardest working rings above it is considerably reduced.

Below the seal ring, gas pressures will be extremely low. Little or no ring wear occurs. In such positions, tapered-face rings may be used effectively where the quick seating ability will assist in additional oil control. Excess oil will be scraped from cylinder or liner walls on the downward stroke and the remaining film more efficiently spread as the tapered face rides over it on the upward stroke.

Naturally, relief of pressure taken alone is not the full picture but this capability of a full seal ring becomes increasingly important as other conditions such as poor lubrication, heat and dirt become involved. Not only does a seal ring relieve pressure on upper rings, but it prevents the destructive forces of hot gases blowing through the gaps of ordinary rings for the full power stroke.

With plain rings this prolonged blowby has the effect of overheating them near the ends, destroying lubrication, and generally raising the working temperature of all the rings in the compression belt. With an effective gap seal ring in place, the volumetric clearances down to its position are very quickly filled and blowby stops

(*Continued on Page* 53)



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SN-75 Midget Hone	Range 1¾" to 2"
JN-95 Junior Hone	Range 2⅛ to 2⅝"
AN-112 Standard Hone	Range 2½" to 7"
AN-812 Heavy-Duty Hone	Range 4¾" to 20½"

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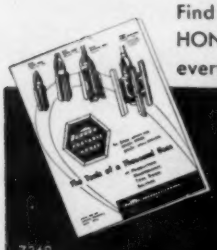
Find out how SUNNEN PORTABLE HONES can help you in your everyday shop work.



SUNNEN PRODUCTS COMPANY

HONING

7930-V Manchester Ave. • St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario

7269

(*Continued from Page* 50)

after only a fraction of the time otherwise involved.

A seal ring should not be used in the top ring groove since it can be seen that if it performs its function effectively, the entire load of both compression and firing pressures would be carried by one top ring only. The wear rate of both the ring and the cylinder or liner would be increased proportionately.

There are many types of seal rings being offered at present. Some of the more prominent styles are illustrated. Rings of single-piece construction having a step-type gap seal as illustrated in sketches 5 and 5A are the least effective of those illustrated since they offer the single advantage of gap closure. Two-piece rings such as illustrated in sketches 6 and 6A offer additional advantages of full cylinder and land seal accomplished by their greater flexibility and conformability to out-of-round conditions.

Spring-actuated conformable seal rings such as that illustrated in sketch 7 have the added advantage of immediate seating regardless of pressure conditions. This ring also follows an out-of-round or wavy cylinder and maintains a complete seal at all times. In worn cylinders, single-piece gap-seal types will concentrate all motion of passing in and out of a tapered cylinder directly at the joint. This results in undue stress at that point and breakage of the seal tongue frequently occurs.

In the 2-piece type seal rings this motion is distributed throughout the ring's full circumference and no part is stressed sufficiently high to promote undue breakage. In the case of the conformable seal ring illustrated, both the sealing tongues on the ring itself and the sealing gib attached to the spring are unrestricted and free to toggle with the inward and outward motion so that no member or part is subject to overstressing.

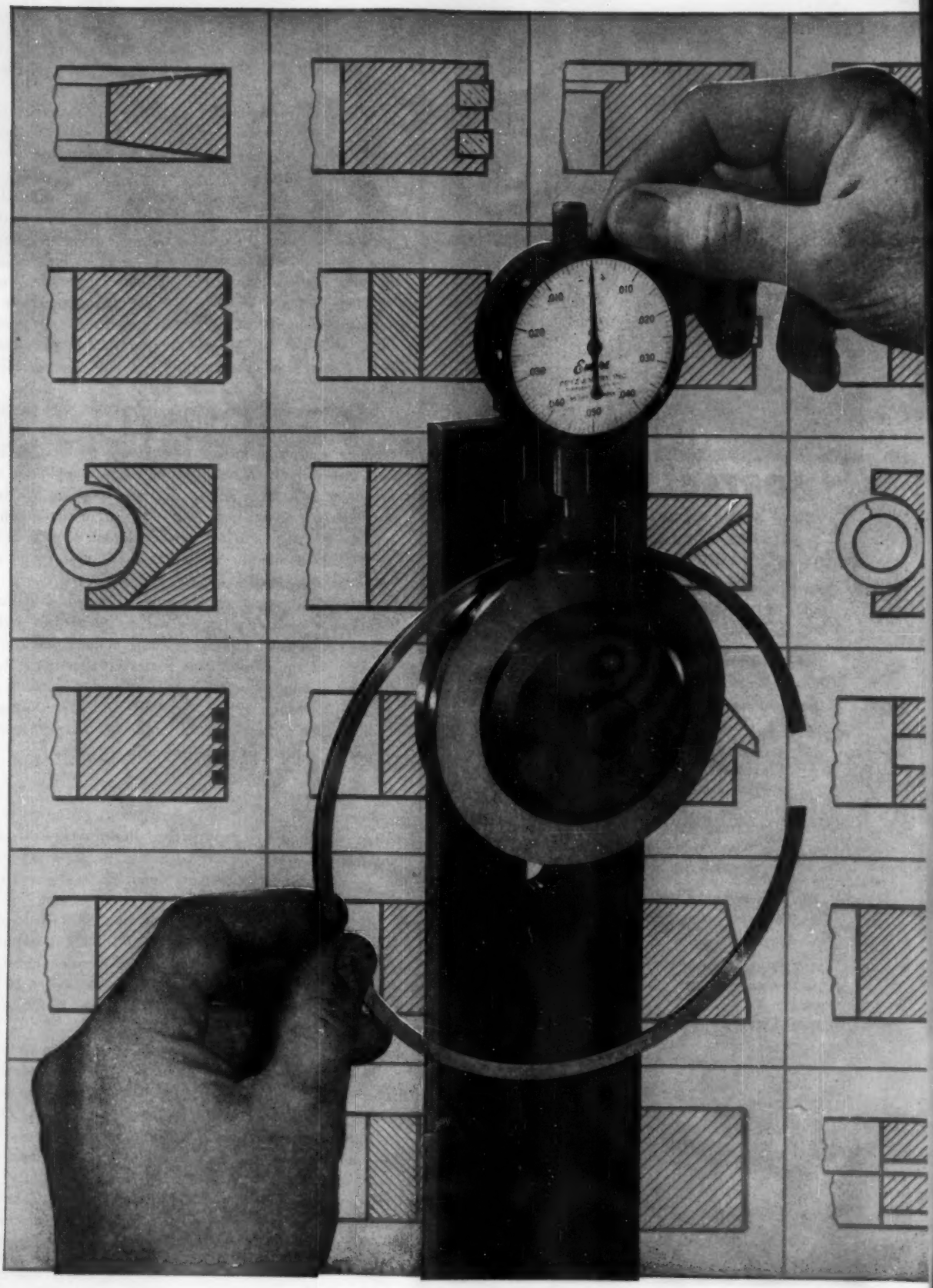
In Summary

Decision to reuse rings starts with measurement of wear as indicated by gap increase. Permissible wear must depend on several factors including the ring type, the engine and its specific output. Manufacturers' wear limits are a good guide.

Ring wear is only one criterion. Condition of the ring grooves, liner or cylinder surface and lubrication conditions must also be considered. Any of these could be the condemning factor. If rings are to be reused, it is important that the best mechanical practices be observed during removal and re-installation.

When ring replacement is indicated, all mechanical deficiencies should be corrected as far as possible. Thought should be given to use of a different ring setup designed to live with the particular conditions. There is often great advantage in changing the type of compression rings used, including use of gap seal rings, and in increasing efficiency of oil ring action.

Get all help possible in reaching decisions. Take advantage of the experience of representatives of ring manufacturers and engine builders. The payoff for right decisions is greatly improved performance.



Let's Face It

Koppers holds that a piston ring is no better than its wearing face

Koppers ability to design piston rings with the precise configuration that meets engine requirements can save you operational and maintenance dollars.

You can select from hundreds of ring configurations that provide optimum sealing with predictable performance in most industrial applications while ideally meeting all requirements of oil control and wear resistance. Or, Koppers, with its 36 years of experience, can design a ring to match your specific requirements.

Koppers Piston Rings have proved themselves wherever piston rings are used and particularly where operating conditions are critical... in internal combustion engines, steam engines, pumps, compressors and valves. Look to Koppers for the solution to your piston ring problems. Write for complete information today to: KOPPERS COMPANY, INC., 1310 Hamburg Street, Baltimore 3, Md.

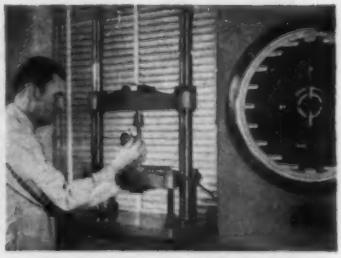
KOPPERS

PISTON AND SEALING RINGS

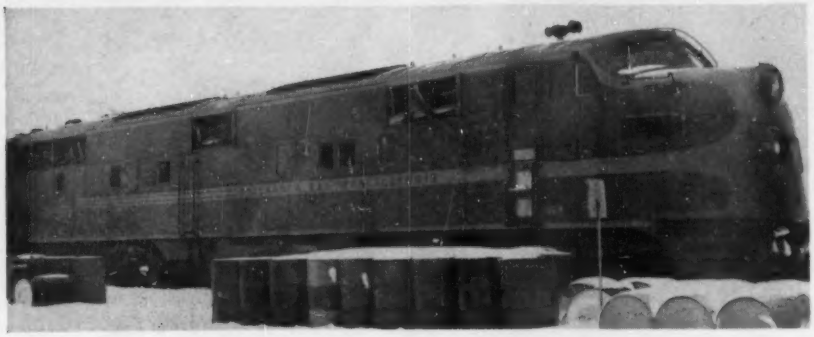
Engineered Products Sold with *Service*

Fluid Dynamics Knowledge gained by Koppers through many years of experience helps solve the most complicated problems involving the control of gases under pressure.

Face Design Knowledge gives Koppers the ability to produce rings and seals that give reliable and economical performance under the most demanding operating conditions.



Materials Knowledge enables Koppers to select the proper material or combination of metals, plastics or ceramics to insure maximum efficiency and length of service.



Chicago and Eastern Illinois 2000-hp Model E7 EMD diesel locomotive before it was completely torn down and put through remanufacturing process.

New Units For Old ...through Remanufacture

One thousand remanufactured locomotive units prove the concept to be economically sound. Remanufacture as opposed to rebuilding means complete upgrading with new unit work capacity, features and warranty. Like a new unit except for cost.

"WHAT is the life of a diesel locomotive?" A realistic answer is that the unit's "life" ends when it becomes uneconomic from a cost or performance viewpoint to continue it. When units reach this stage, railroads can do one of three things—junk them and buy new ones, rebuild them in railroad shops, or if they are EMD units, send them to the Electro-Motive Div. of GM for remanufacture and upgrading.

Replacement costs are high and most railroads are not in a position to spend the money. Rebuilding in railroad shops would only stretch locomotive life to the next rebuild but gives no increase in capacity. In the case of EMD units, remanufacture and upgrading means getting greater locomotive capacity with new locomotive warranty at a cost much less than buying a new unit.

Savings to railroads having their diesels upgraded are almost as great as those realized in the original steam-to-diesel shift—30% or better. This is accomplished through greater fleet capacity and flexibility, handling faster schedules, and reduced operating and maintenance expenses.

EMD figures that 6500 of its freight locomotives alone, built since World War II, will either have to be scrapped or upgraded between now and 1965. This is excluding passenger units and switchers. In fact, EMD has just celebrated upgrading of the thousandth locomotive at their La Grange plant. This upgrading represents a railroad investment of about $100 million.

EMD Upgrading Process

This thousandth locomotive is a typical product of the upgrading process which is turning out locomotives at the present rate of one a day. The old unit, a Model E7, came into the EMD plant a 2000-hp scratched and scarred veteran of 12-years service with 1,664,000 high-speed miles behind it. The new one, went out a modern Model E9 with 2400 hp, the latest design improvements and a 100,000-mile new locomotive warranty—yet cost $110,000 less than a new E9. This is typical of the EMD standardized, mass production method of relaiming old diesel locomotives.

Under the technique, components from old units can be remanufactured and incorporated into the latest model locomotives of their same type, or even a different type. EMD is able to do this for two reasons: (1) old and new parts and components are designed so they can be installed together and operate in complete compatibility and (2) EMD's specialized mass production technique successfully mingles remanufacture of old components with original manufacture in the same production lines. Thus, the same engineering methods and latest specialized machinery, tools and instruments are used for both manufacturing of new, and upgrading of old equipment.

Old locomotives are completely torn down. All components are inspected to determine which can be economically upgraded. Those that can be are sent to various production departments—engines to the engine line, generators to the generator department, etc.

In this 1000th unit, two 12-567A engines powering it were upgraded to 12-567BC engines with a total boost of 400 hp. This remanufacture eliminated earlier water and oil leak problems.

The four traction motors were upgraded to D-47 units with tractive effort increased in proportion to the boost in horsepower.

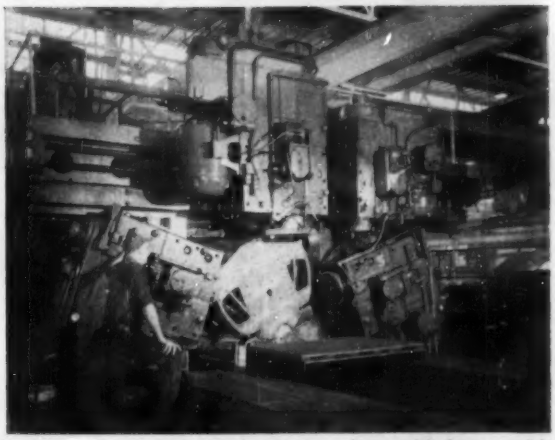
Other important improvements included:

An a-c cooling system which eliminates belt drives.

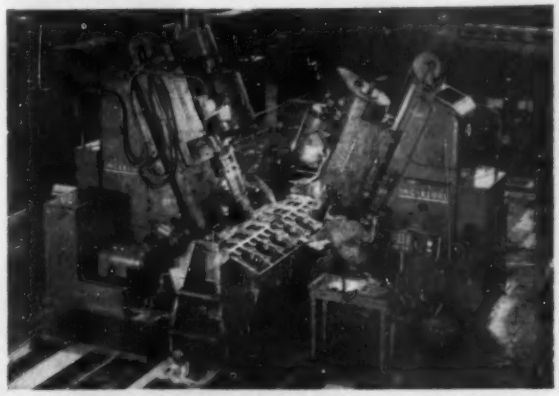
Water-cooled air compressors which reduce air brake system maintenance.

A new E9 equipment rack which improves lube oil cooling and filtration with reduced maintenance.

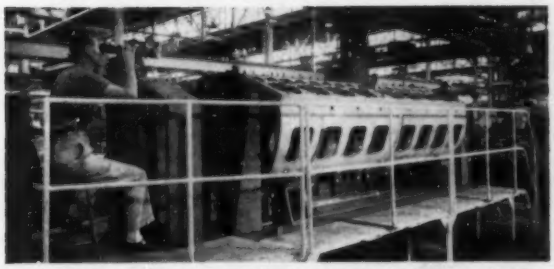
A new Woodward PG electric-hydraulic engine governor which gives greater stability, and smoother engine operation and train handling.



Machining top deck of diesel engine crankcase with huge special-purpose machine developed by EMD for mass-production operation.



Cylinders on both sides of vee-type engine are milled at same time by use of special large vertical boring milling machines.



Telescopic inspection of machined surfaces of diesel crankcase.

One of world's largest portable milling machines is seen milling the top deck surfaces of a diesel locomotive underframe.

A new E9 electrical control system which gives more reliable locomotive operation and quicker and easier locomotive control, eliminates monthly inspections and drastically cuts electrical maintenance costs.

New gear cases which retain lubricant longer, thus reducing maintenance.

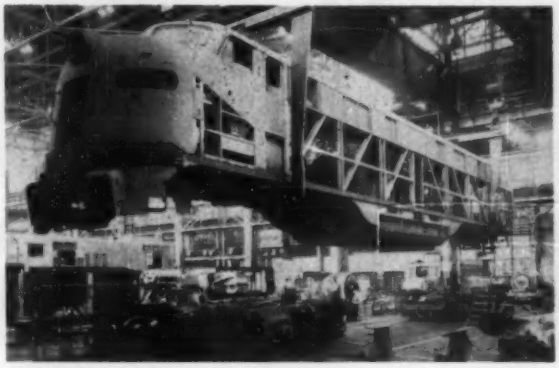
A new cab heating system that increases crew comfort, contributing to alertness.

An internal reset for emergency fuel cutoff which eliminates crawling under the locomotive to reset the emergency fuel cutoff valve.

These are the highlights of all the improvements made and are typical of the upgrading process.

While the above mentioned components were being remanufactured or new ones obtained, a new stronger underframe, and E9 body with improved ventilating arrangement and winterization protection, were being built. When ready, the upgraded engines, generators, traction motors, and new parts and assemblies went to the main erection room and were incorporated onto the underframe and body.

The body was then dropped onto the underframe and welded in place. This unit was dropped onto the upgraded trucks and run to the test building. Here the locomotive undergoes the same exhaustive testing as a completely new unit. The locomotive then goes through the same paint shop as a new unit and is ready to return to the railroad.



Containing many remanufactured components of old E7, new 2400-hp, E9 nears completion as body and underframe are dropped on trucks.

"Eliza Doolittle", one-thousandth locomotive to go through EMD upgrading process, as it appeared after it was remanufactured.

Cold Rolling Puts a Tougher Face . . . on an "Old Salt"

To increase fatigue resistance, endurance limit and to fight the corrosive action of the sea, Erie Forge & Steel technicians cold roll ship's tail shafts as illustrated above. The life of the forged steel tail shaft is prolonged by cold rolling under the propeller and the after bearing. The surface toughness thus effected reduces fretting corrosion, minimizes pitting, costly failures and the hazard of propeller loss at sea.

Cold rolling is applied not only to new shafting but also for reconditioning existing ship's shafts, thus saving sizeable replacement costs in many instances.

Designed and built by Erie Forge & Steel engineers, the machine cold rolls shafts of any length and up to 30 inches in diameter. Any desired pressure up to 37,000 pounds can be exerted by the hardened steel rollers on each side of the shaft.

The Society of Naval Architects and Marine Engineers recommends that all ship's propeller shafts be cold rolled as a safety measure. This cold rolling process is approved by The Bureau of Ships, United States Navy.

Another of the special services characteristic of the continuing progress in steel improvement at Erie Forge & Steel. Let us work with you on your steel forging and casting requirements.

ERIE FORGE & STEEL CORPORATION

ERIE, PENNSYLVANIA

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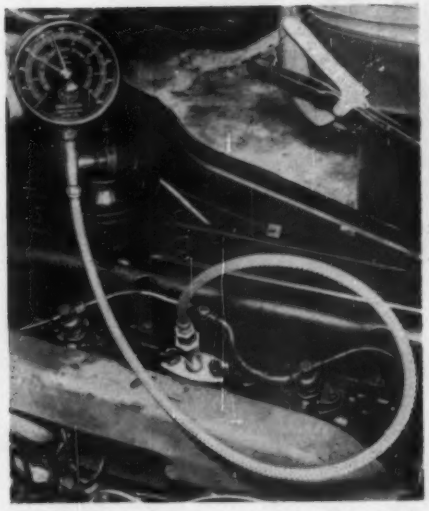
Injection Tested While Engine Runs

Injection equipment can be checked and adjusted right on an operating engine with British test devices.



"Dieseltester", a compression gauge, checks cylinder compression pressure through nozzle opening in head.

FOR a balanced engine, fuel delivery to each cylinder should be the same. This is the condition you want when the engine is working, is up to normal temperatures, and is using its normal fuel.

Engine builders, using elaborate equipment, get this condition. When checking engine performance, the best nozzle settings for power and economy are found. These values are translated into those published in service manuals for use in bench testing and setting nozzles.

A British firm, Dunedin Engineering Company, Ltd., figured that the closer field setting procedures could come to factory methods, the better the results. Their tests indicated that while values for static testing were statisically correct, giving good average results, they did not allow for all the variables that could be present in specific engines.

Test Equipment Developed

Dunedin set out to develop simple test equipment to perform all the usual tests under true working conditions with the engine running. Three items of diesel test equipment resulted. The "Diestester" is an accurate compression gauge. Unless compression is substantially the same in all cylinders, work expended in precision balancing is wasted.

Two kits for checking and setting injection equipment were devised. The less-elaborate and lower-cost "Injectometer" provides for dynamic setting of nozzles and spray pattern checks with the nozzle removed from the engine. At the same time, dribble and leak-off can be checked.

The more elaborate "Injectester" performs all these functions plus others involving the pumping element and delivery valve. Its use will be covered.

These kits have two important advantages. First, they permit accurate dynamic setting of nozzles. Second, they can be used to diagnose system troubles. These can be quickly and accurately located, then corrected with minimum dismantling and loss of time.

Two limitations should be noted. They will not measure the actual output of nozzles. This should be balanced by flow testing. Second, while the "Injectester" will give an indication of calibration accuracy as well as pumping element and delivery valve condition, it does not take the place of normal pump calibration, timing, etc.

Using the Injectester

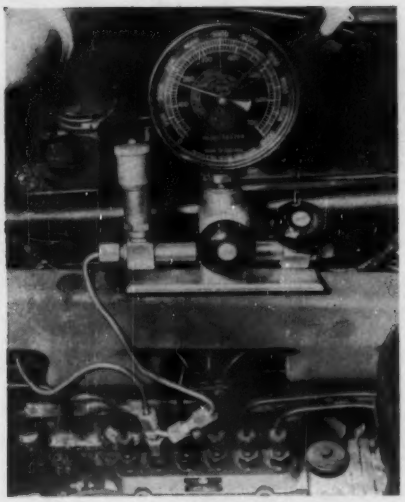
This device is illustrated and its components pointed out in the caption. Since the tester is connected to the high-pressure line between the pumping element and its associated nozzle, its gauge reflects all the pressure variations in the line. Pressure patterns show whether conditions are normal or abnormal.

For example, rapid needle fluctuations of the gauge needle mean that the pump's delivery valve or the nozzle's needle seat is faulty and losing pressure. A further check can be carried out by testing the delivery valve separately. By quick elimination, the point of failure is found.

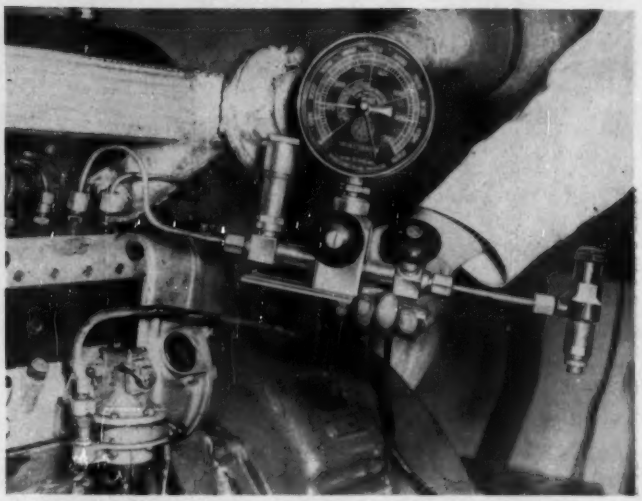
To test and balance injectors, the equalization point of delivery line pressure and injection pressure is found by a simple procedure. Then both tests and setting can proceed. Faulty injectors must be removed and repaired before final adjustment can be made.

Some indications of pump condition can be obtained. When tested in full-rack position, line pressure is noted. If it remains high after the initial surge, it is a sign of over-calibration. If it does not rise above injection pressure, under-calibration is indicated. In both cases, the pump should be removed for a calibration test.

Direct tests for delivery valve and pumping element condition can be made by connecting the pump discharge directly to the Injectester. The tester's relief valve



"Injectester" is connected to high-pressure line between fuel pump and nozzle. Pressure variations on gauge show if conditions are normal or not.



"Injectester" is seen connected to fuel pump and nozzle. Injector is being tested under actual operating conditions. Instrument components from left to right are—pressure regulating valve, dial cutoff and relief valve.

is set at twice recommended injection pressure. The engine is started, the tester properly bled of all air, and pressure buildup is noted. Regular fluctuations of 30 to 50 atmospheres tell that the delivery valve cut-off (retraction piston) is worn. Irregular fluctuations indicate the delivery valve seat to be faulty. Rapid pressure drop when the engine is stopped is a sure sign that the delivery valve needs attention.

If the pumping element is in good condition, pressure buildup to the relief valve setting should be steady. If pressure builds up more slowly as higher pressure levels are reached, it is a sign of plunger leakage. This can be verified by pressure drop tests with the delivery valve removed from the pump.

These examples show the type of tests possible with this equipment and demonstrate its versatility. Complete testing programs are or can be worked out for a wide variety of injection equipment. Also, Dunedin states that the Injectester is effective for use on engines from the smallest up to 20,000 hp sizes.

Correlation of Results

When questioned regarding the correlation of dynamic settings with those obtained with conventional pop testers, Dunedin engineers supplied the following data.

"Correlation between bench testing and the engine setting method varies according to conditions of the delivery valve seat, the nozzle seat, the cut-off of the delivery valve, the pumping element, also the fuel used. Injector temperature can also account for injection pressure variations.

"Bench testers have fixed diameter plungers that may not be suited to the particular size of nozzle being set. Improper matching can cause false settings whereas when testing on the engine, the correct plunger size is always used.

"Wear of the components is a factor. If not too great, the effect can be minimized by adjusting the nozzle with the engine running. For example, conpensation can be made for any small difference in wear of pumping elements. This is proved by setting the injector to one pump element and then testing it on another. Setting will vary according to the amount of wear and may be as much as 10 atmospheres."

Obviously, if all nozzles were set on one pop tester, each would be subject to the variables in its particular system when operating. Early-breaking nozzles would advance timing and late ones retard it. Set to open at the required pressure when working with its associated system components, greater uniformity of delivery and hence better engine balance is achieved. Improved horsepower and better fuel economy result. Another result of a well-balanced engine, where all cylinders are pulling identical loads, is that chance of exhaust smoke is cut to a minimum. This is of great importance in areas where even small amounts are objectionable.

Again, it should be said that flow testing is the only way to balance actual injector output. However, this does not take into consideration variations in the individual pumping system. So while flow testing balances injector output, another step is needed to balance the injection pressures among the pumping circuits.

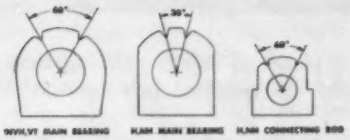
Conclusion

This test equipment stands on its own feet as a tool for diagnosing injection troubles. It has the advantage of pinpointing faults dealing with the injection system as a whole—not as individual components on a bench—and in the field and during operation.

It also offers a refinement in the procedure of setting injection nozzles by doing it under dynamic conditions. Proper opening pressures can be set with the injector at operating temperature, working with its normally-associated components and with the fuel normally used.

service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you



Cummins H and NH Main and Conrod Bearing Lockplates

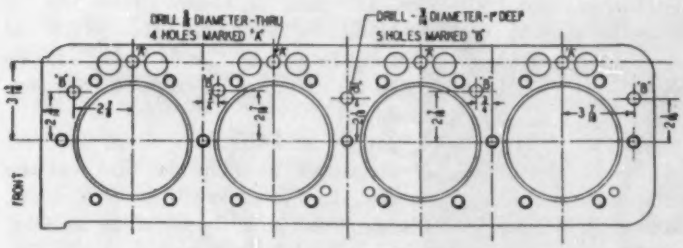
Main and connecting rod bearing lock-plates now are made with two notches, or template marks, 60 degrees apart (30 degrees apart for H and NH main bearings) as an aid in using the template method of tightening bearing caps.

Always use the template method for tightening main and connecting rod bearing caps as indicated in the table.

There are three provisions for checking the 60-deg (or 30-deg) advance for the fourth or final step in the torque tightening procedure. They are: markings on caps; markings on lockplates; and the 60-deg facings on each hex nut.

One or more of these markings is always visible, or as visible as the torque wrench dial, even while working under a truck.

	A. Tighten Ft Lb	B. Loosen	C. Retighten Ft Lb	D. Advance Degrees
Connecting Rods: H,NH	140	Loosen Completely	50/55	60
Main Bearings: H,NH	150 and Advance 30°	Loosen Completely	140	30
NVH,VT	125 and Advance 60°	Loosen Completely	125	60



IH Cylinder Head—142 Series

A new type cylinder head is available for the International Harvester Model UD-14A Power unit and TD-14 (142 Series) Crawler Tractors. Here are the improvements made:

(1) A water baffle is incorporated 1-in. above the lower deck.

(2) Clean-out holes are added and intake and exhaust ports improved.

(3) A new cylinder head gasket with elongated holes between cylinders 1 and 2 and 3 and 4 is now used.

In conjunction with the new design cylinder head, the crankcase is modified so that water holes to the cylinder head are revised. When a new cylinder head is ordered, the accompanying modification diagram will also be included.

Old cylinder head gasket 50 675 DD may be used with old cylinder head, 251 062 R81, but *cannot* be used with new head 277 297 R11 or 277 493 R91. *New cylinder head gasket,* 278 754 *R must be used with new cylinder head* 277 297 *R*11 *or* 277 493 *R*91.

Injection tubing has also been redesigned to conform with cylinder head change.

Lube Oil for Cat Starting Engine

The Fall of the year brings many types of weather. In the northern hemisphere, the days may be warm while the night may bring freezing temperatures.

Under these conditions, the best solution is to use SAE 30 oil in both the starting engine and diesel crankcases and after shutting the diesel down for the night, dilute the oil in the starting crankcase with kerosene. After adding kerosene, start the starting engine and operate just long enough to throughly mix the kerosene and oil.

Do not crank or start the diesel until the morning when you're ready for the day's operation. If started and allowed to operate for only a few minutes, the diluted oil will be carried into the diesel engine crankcase.

The small amount of diluent required to thin the starting engine crankcase oil will hardly be noticeable when that oil is mixed with the oil in the diesel crankcase. Also, the heat from the diesel engine during the day's operation will evaporate most of the diluent by the end of the day and if freezing temperatures are expected again that night, the same dilution procedure should be followed.

industry news

Five Diesel Locomotives Pull 100-ton Ore Cars

Six hundred modern ore cars, each capable of carrying 100 tons, are being placed in service carrying iron ore from Kaiser Steel's Eagle Mountain, Cal., mine to its steel mill at Fontana. Conventional cars heretofore used in handling the ore could only load about 65 tons.

A run of 100 of the new cars, built by the Southern Pacific RR, hauled nearly 10,000 tons of ore recently. This was said to be the heaviest load ever pulled over Beaumont Pass in Southern California.

Five diesel locomotives were needed to control the weight down long grades. Fourteen diesel units with a total of 23,500 hp were needed on the upgrade of the Beaumont Pass.

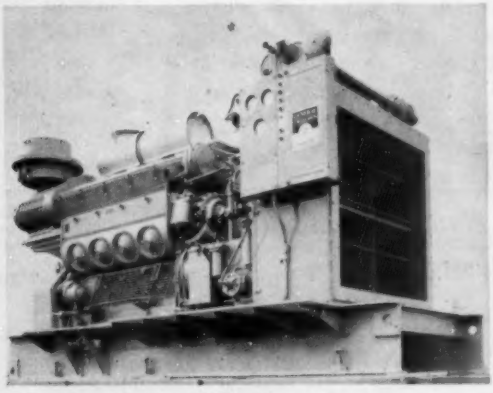
Woodward Holds 22nd Prime Mover Control Conference

Over 100 technicians from 50 domestic and foreign companies attended the Woodward Governor Company's Twenty-Second Prime Mover Control Conference in September. Some of these technicians are seen around a new, special Swiss jig borer recently installed.

Each year engineers go to the Woodward plant in Rockford, Ill. to get a great amount of technical information on hydraulic governor applications. Sessions include classes on governors for diesel, dual-fuel, gas and gasoline engines and for water and steam turbines and aircraft engines.

The conference is open to all foreign and domestic industries using hydraulic governors, also to interested branches of the U. S. and foreign governments.

Objectives are to acquaint conferees with fundamental principles of Woodward governors; governor design and operation; and field maintenance and repair procedures plus those requiring special attention at the factory. Lectures and demonstrations range from basic governor theory, maintenance and operation to more advanced technical subjects at the engineering level.



Self-Contained Diesel For Pumping

A 900-hp self-contained diesel set is being moved from the La Grange, Ill., plant of Electro-Motive Div. of G.M. to Lake Maracaibo, Venezuela. This SK-10 and an identical unit will be used by Sun de Venezuela, subsidiary of the Sun Oil Co., to pump crude oil from storage tanks into ships.

The SK-10, features an EMD 8-cyl Model 567C engine with all accessories including fan and radiator mounted on a skid. Its overall length is 18 ft, width, 7 ft-8 in. and height, 9 ft-8 in. to the top of the air filter. Dry weight of the unit is 31,500 lb.

It is designed to meet the demand for stationary applications requiring a complete engine set in the 900-rpm, 900-hp class.

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SAE National Transportation And Diesel Engine Meetings

Potential applications and service of multifuel engines will be reviewed at a symposium. This will highlight the SAE National Transportation and Diesel Engine Meetings to be held October 20 through 24 at the Lord Baltimore Hotel in Baltimore, Md.

The meeting program calls for a half-day symposium on October 23, and presentation of six technical papers. These will reveal experience with multifuel engines as reported by military authorities, motor truck manufacturers and various companies which have built and operated the engines on many different types of fuel.

Some of the subjects to be covered by the technical papers include: utility engine combustion chamber deposits; diesel engines for light duty operation; multifuel engines; cold starting diesels; supercharging free-piston engines; turbocharged diesel engines; and inter-cooling of diesel engines.

Diesel-Generator Sets Shipped to South Vietnam

Four 2865-kw diesel-driven generators are on the way to South Vietnam from General Electric Company's Schenectady, plant. These units will boost South Vietnam's electric power capacity about 15%.

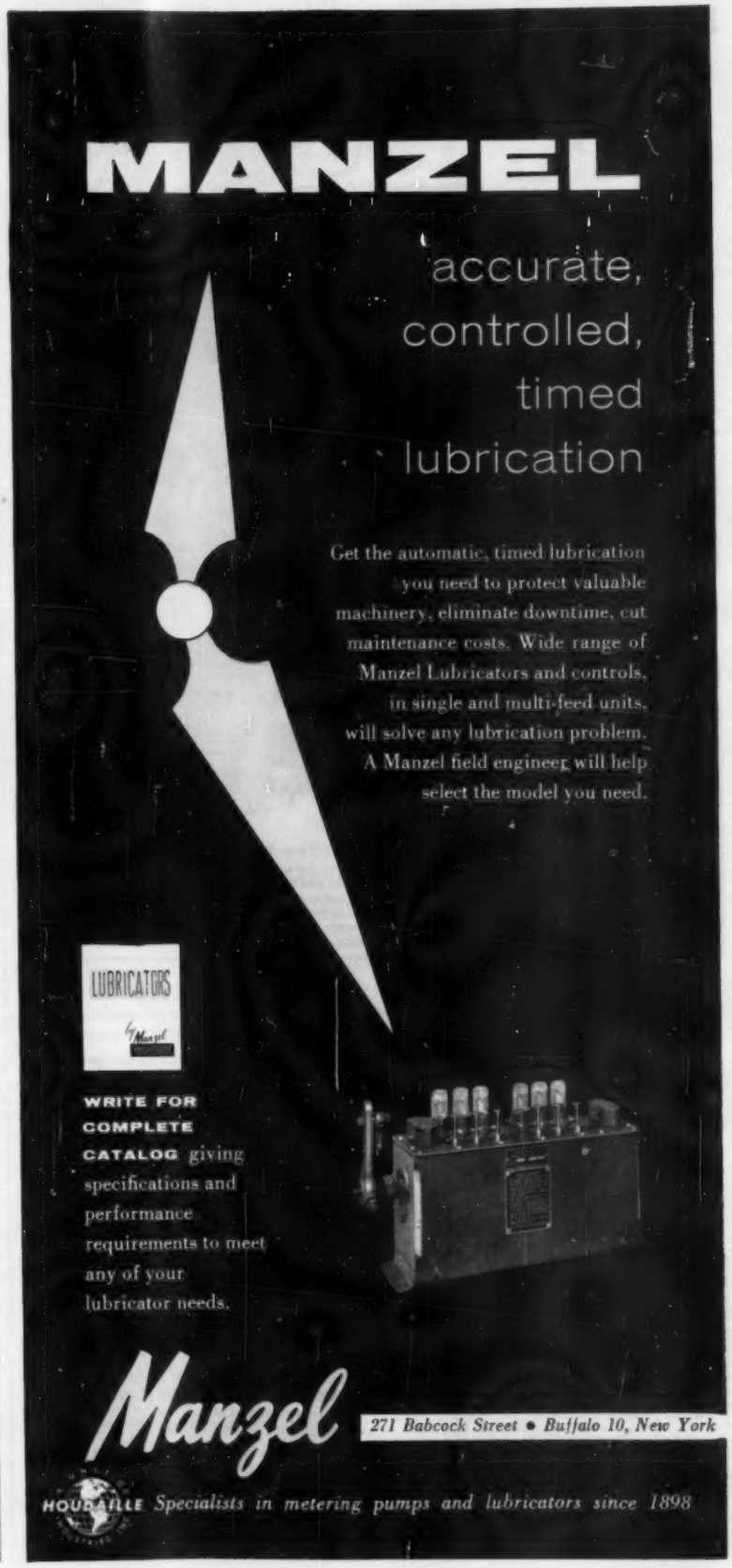
The four units were purchased by the Indochina Water and Electric Co. Three units will be installed in a new power plant in Saigon.

The GE generators are powered by Worthington SW-14, 16-cyl, vee-type supercharged diesels developing 4000 hp at 428 rpm. They are rated 3581 kva, 6700-v, 3 phase, 50 cycle.

An AQI design, 500-v, unit will generate 2-phase, 50-cycle current at the utility's present station at Pnom Peuh.

Pittsburgh Railways Buys Mack Buses

The Pittsburgh Railway Co., Pittsburgh, Pa., has bought 14 Thermodyne diesel-powered transit-type buses from Mack Trucks, Inc. This brings to 24 the number of new Mack buses sold to them since last October.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accurate, controlled, timed lubrication
Get the automatic, timed lubrication you need to protect valuable machinery, eliminate downtime, cut maintenance costs. Wide range of Manzel Lubricators and controls, in single and multi-feed units, will solve any lubrication problem. A Manzel field engineer will help select the model you need.
LUBRICATORS by Manzel
WRITE FOR COMPLETE CATALOG giving specifications and performance requirements to meet any of your lubricator needs.
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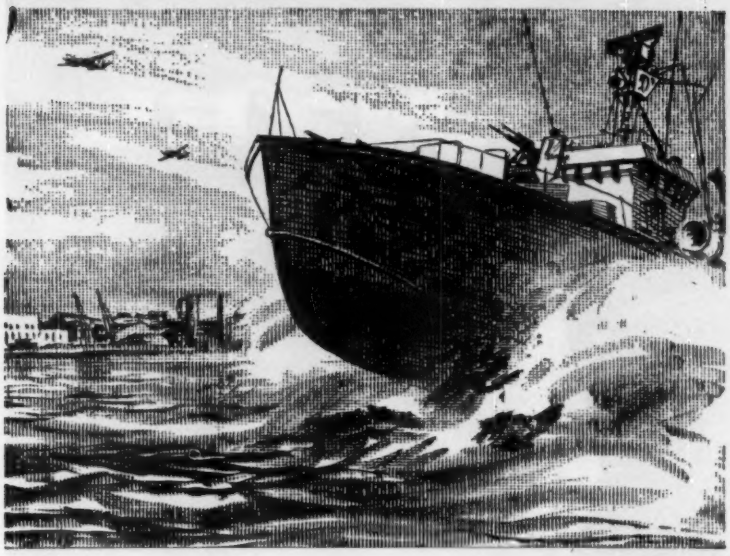
271 Babcock Street • Buffalo 10, New York
HOUDAILLE Specialists in metering pumps and lubricators since 1898

MORE POWER AT LOWER COST



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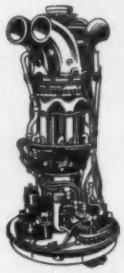
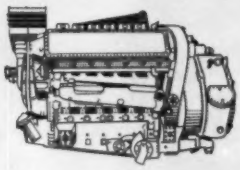
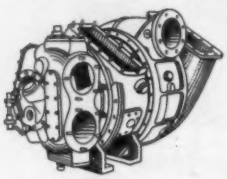


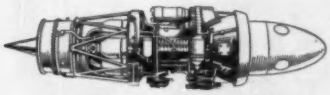
GAZELLE 1260/2000 s.h. p. Free Turbine:
designed for strenuous duty and long service between overhauls. Chosen for R.N. and R.A.F. helicopters. Allows new flexibility in helicopter design. Its simplicity means economical and speedy maintenance.



DELTIC 9 or 18 cylinder Diesel:
engine for merchant ships. Powers fast patrol boats and mine-sweepers of many Navies, police and passenger launches and the world's most powerful diesel electric locomotive. Deltic Diesel Engines are designed for power outputs from 825 to 3,100 h.p.

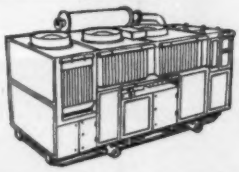


ELAND 3000/4000 e.h.p. Turbo Prop:
heralds a new era of economy for the airline operator and cheaper fares for the air traveller.
The Eland powers the Canadair 540 Airliner, the Fairey Rotodyne and the Westland Westminster Helicopter.



TURBO BLOWERS:
available in seven sizes for diesel engines afloat and ashore. Napier blowers give maximum power increase with low fuel consumption. Now in service in 34 countries.

DELTIC COMPAK
A compact source of power, easily transportable to normally inaccessible places, comprising Deltic Diesel engine plus generator, radiators, fuel tanks, pumps, etc. Road, rail and skid mounted sets at 1,200 kW and rail mounted sets at 2,640 kW. Weight 35,000 pounds. Envelope 24x8x11 ft



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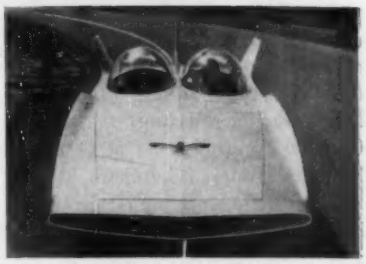


Front view shows grille, passenger bubbles.

Gas Turbine-Powered Car

A new experimental gas turbine-powered Firebird has been built and tested successfully by General Motors. Firebird III is designed around a single stick control system which eliminates the conventional steering wheel, brake pedal and accelerator.

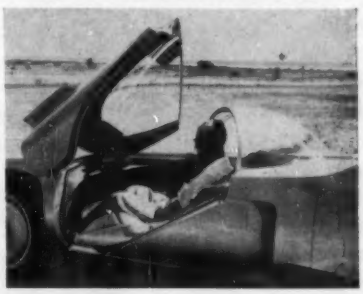
This Unicontrol handle combines all steering, braking, accelerating and parking functions.

The two-passenger car uses electronics, transistors and computors to guide it automatically and control passenger comfort.

Firebird III uses a dual engine system. A 10-hp, 2-cyl, 53-lb, aluminum engine drives all accessories. This frees the 225-hp, 600-lb, Whirlfire GT-305 regenerative gas-turbine engine to drive the rear wheels through a modified Hydro-Matic transmission. The improved gas-turbine engine is lighter, more compact, 10% more powerful and consumes 25% less fuel than the gas-turbine engine in Firebird II.

The first public display of Firebird III will be at the GM Motorama of 1959, October 16, at the Waldorf-Astoria Hotel in New York City. The Motorama will move to the National Guard Armory in Boston on November 8.

Canopy lifts for access. Wheel is absent.



Mack Engineer Gets Top Award

Jack F. Greathouse, New Development Supervisor, Engine Div., Mack Trucks, Inc. has won the John Woodman Higgins Redesign Award for 1958.

This national design award is sponsored by the Pressed Metal Institute, Cleveland, O. It was given to him for designing an engine manifold which saves 12 lb in weight and 40% in cost.

The new design involves a change-over from sand cast aluminum manifolds. Manifolds are now stamped in halves from sheet metal and then welded into a single unit.

Worthingon Gas Engine For Sicily

The Augusta Petrochimica Co. is completing a new synthetic ammonia plant whose product will be used in the production of fertilizers. It's located near Priolo, Sicily.

Compressed air for the plant will be produced by a centrifugal compressor driven by a Worthington 8-cyl, 2120-hp gas engine through a Voith fluid coupling and a speed-increasing gear (375/11200 rpm) furnished by Renk-Augsburg (Germany). When completed in 1959, the plant will be one of the few installations in Europe of a gas engine-driven centrifugal compressor.

Mobile Power Plant For Emergency Use

A 1000-kw "Electro-Mobile" power car, purchased recently by Saskatchewan Power Corp. is filling a vital need in that Province. The 1440-hp diesel powering the unit was made by GM Diesel, Ltd., London, Ontario.

Located on the Riverhurst-Moose Jaw line, the boxcar-size unit provides service in case of transmission line breakdowns. It is completely automatic. On receipt of a predetermined impulse, the controls can start the unit, synchronize and have the unit on the line in about 60 seconds. A 6-mile line was constructed to connect the power distribution system with the unit which is located on a railway spur.

(*Continued on Page* 84)

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new products

Diesel Nozzle Analyzer

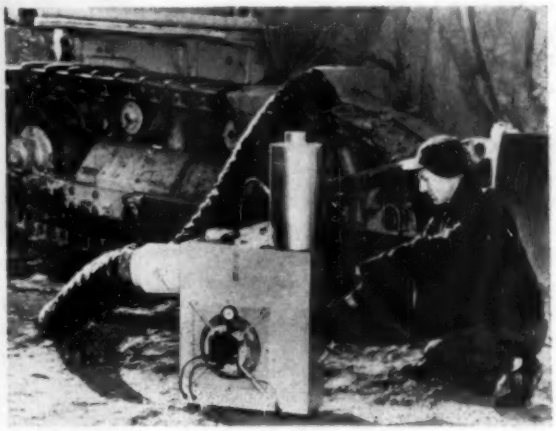
Leslie Hartridge Ltd's diesel nozzle analyzer, now being distributed in the United States, has been improved. It is now fitted with a built-in fume exhauster and provided with a wide range of adaptors. Accurate testing of a nozzle is achieved by controlling the length of the injection period so that the action of the needle can be observed in slow motion.

Incorporating a patented Presco-Time Recorder which permits time and pressure readings to be taken simultaneously, spray target and cabinet, and a quick-action injection holder, the analyzer enables a variable rate of flow to be achieved from nil to full demand of the nozzle orifice. Speed in testing is faciliated by quick-action injector clamps which eliminate delivery pipe and nut connections.

Cold Weather Equipment Heater

Cold weather problems, especially those concerning frozen and sluggish construction equipment can be considerably reduced with the use of MoPeCo Model GHE ventilating heater. This 110-lb unit made by Morrison-Pelsue Co., Denver, Col., is a portable heater delivering 1200 cu ft of fresh, heated air through flexible, spring-reinforced ducts. A gasoline engine-powered blower forces the hot air onto equipment engines, transmissions, personnel enclosures and other parts which need to be warmed or repaired.

All products of combustion pass harmlessly into the atmosphere. Hot air from the heater is safe, breathable air. Crews can easily repair or thaw inoperative major equipment by throwing a trap over the work area and running a duct into the bottom.



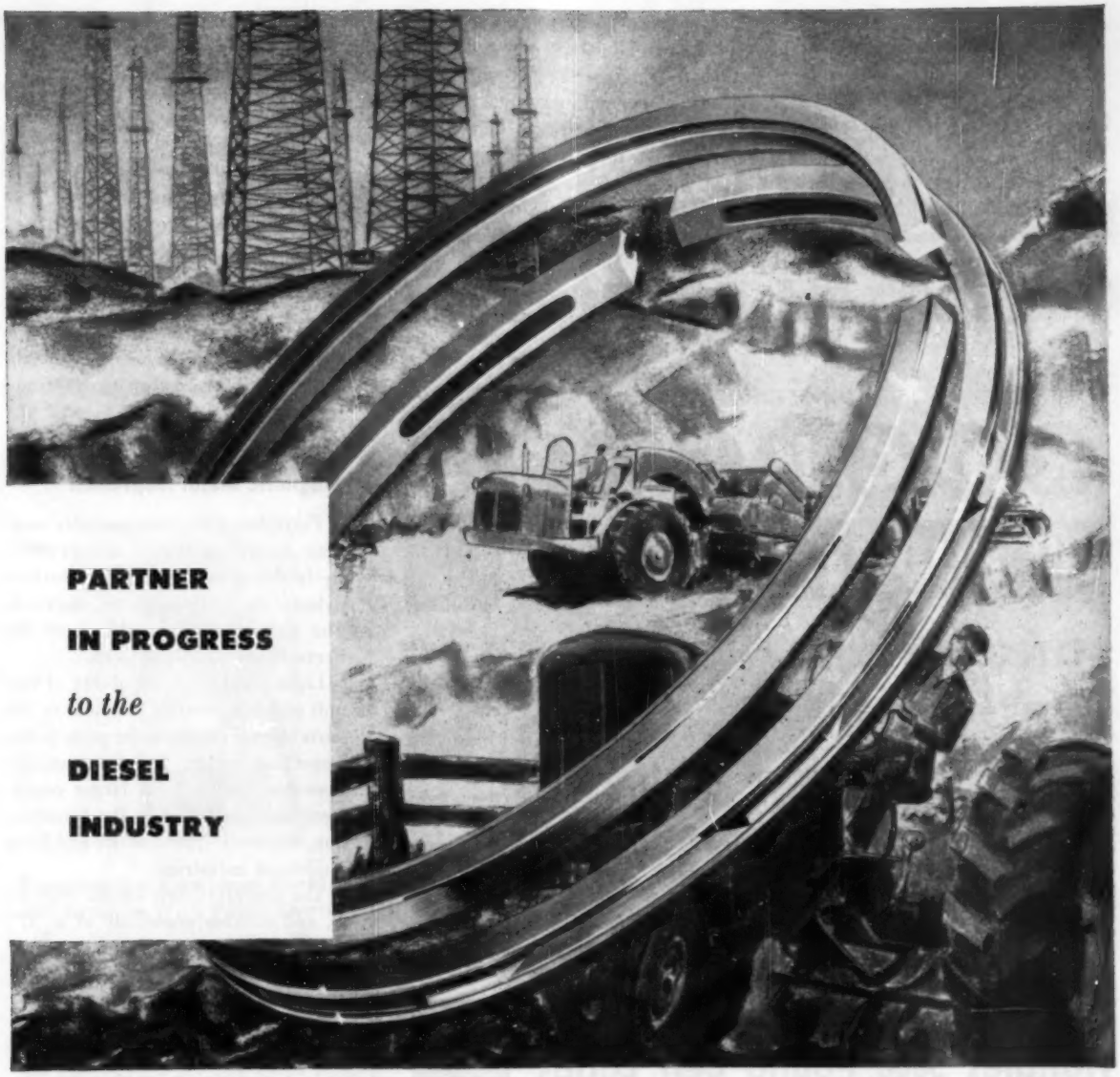
Diesel-Powered Giant Earthmovers

R. G. LeTourneau, Inc. has introduced what are said to be the largest self-propelled earthmoving scrapers ever placed on the market. These are in the 70 and 125-ton class—roughly equivalent to 50 and 100 cu yd capacity. First public showing of a 600-hp diesel-powered 70-ton unit was at the American Mining Congress in San Francisco.

Major difference between this and conventional scrapers is that each wheel of the new machine has an individual d-c electric motor geared directly to its inner rim. This provides greater traction and working power under the payload. Motors (a-c) are used for steering and for manipulating the loading and unloading mechanisms.

All electricity required is generated by a 600-hp Cummins diesel, coupled to LeTourneau-built a-c and d-c generators under the hood. Power is transmitted by electric cables, avoiding use of mechanical drives.

(*Continued on Page* 68)



Leading diesel manufacturers turn to Perfect Circle—with confidence!

No other rings are backed by such rich resources in research and engineering. And no other ring manufacturer matches the Perfect Circle record in ring designs for all types of applications...automobiles, trucks, tractors, marine and aircraft...including rings for diesel duty designed in close co-operation with diesel manufacturers.

No wonder so many big names in diesels use Perfect Circles as original equipment... and for replacement service too. That's a fact worth keeping in mind whenever you specify piston rings. And if you're faced with any problem concerning rings, remember that you are welcome to consult with our engineering staff at any time. Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., Don Mills, Ontario, Canada.

PERFECT CIRCLE PISTON RINGS

new products

(*Continued from Page 66*)

Explosion-Proof Hour Meter

A new explosion-proof hour meter, is available for use on diesel or gasoline engines, fork lift trucks, generators or air compressors which might be located in hazardous locations. It is made by the John W. Hobbs Corp. a division of Stewart-Warner Corp.

Line-Type Hydraulic Filter

A new line-type filter made by Marvel Engineering Co. can be used for coolants and lubricants, hydraulic oils, and fire-resistant fluids. It is applicable for pressures up to 150 psi, up to 300°F.

These strainers are made in sizes of 10, 20, 30, 50 and 75 gpm with choice of Monel wire cloth mesh sizes from 30 to 100. All units are available with or without by-pass valve.

ROCKFORD

OIL FIELD TYPE

LONG LIFE
Heavy-Duty

POWER TAKE-OFF

Handles 5000 Pound Belt Loads

Eliminates the Pilot Bearing
Release and Main Bearings are lubricated for one year
Main Bearings are 40,000 hour type
Handles 5,000 pound Belt Loads
Out-Board Bearings and Flexible Couplings eliminated
Furnished with Single or Double Plate, Organic or Morlife* faced Gear tooth Type Clutches

Insure longer work life and reduce down-time with this NEW extra heavy-duty ROCKFORD POWER TAKE-OFF.

SEND FOR THIS HANDY BULLETIN
Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

ROCKFORD Clutch Division BORG-WARNER
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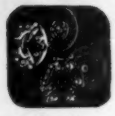
CLUTCHES


Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

Improved A-C/D-C Tong Test Ammeters

A new tong test a-c/d-c ammeter with improved features is now available from the Columbia Electric Mfg. Co. It is said to be the only instrument of its type that measures both alternating and direct current.

To operate the new unit just press the trigger and snap the tongs around an electrical conductor without breaking circuit or insulation. The tong test is available in eight different types and measures up to 1000 amperes.

Magnetic Metal Inspection

Ferroflux, a low-cost, portable magnetic inspection device said to effectively detect surface and sub-surface defects in ferro-magnetic material. The unit is now available from the Ferro Machine & Tool Corp.

Light-weight and portability of this unit makes it possible to take it to the parts instead of taking the parts to the inspection device. This is especially desirable for use with larger equipment such as found in the construction, automotive, locomotive and farm implement industries.

The Ferroflux unit weighs only 23 lb, and consists essentially of a "U" shaped 110-v electro magnet which operates at 0.175 kva.

Fast, Cold Carbon Remover

A new non-toxic, cold carbon remover, Lo-Tox 775, made by Octagon Process, Inc., is said to offer a fast, safe method of removing hard carbonized oil, sludge and dirt from all diesel engine parts. Parts cleaned in Lo-Tox 775 are protected against rust through its inherent rust-inhibiting property.

The parts to be cleaned are placed in the tank of Lo-Tox 775 and do not require any attention until they are ready to be rinsed and used. Lo-Tox 775 removes dirt, grease, carbonized deposits, lacquer and paint completely to the bare metal. An inhibiting agent prevents attack of nonferrous metals, such as brass, babbitt, aluminum, etc.

New Method of Spray Cleaning

Tysol Products, a division of Chemical Research Associates has a new method of spray cleaning diesels. The cleaning is done with their portable Tysol Spray cleaning unit Model No. 525 and the Tysol Cleaning and rinse gun Model No. 500.

Major advantages claimed are: 1. No heat required for cleaning or rinsing operations. 2. Controlled use of water. 3. Controlled spray pattern. 4. Cleaning time reduced 50 to 75%. 5. More thorough cleaning. 6 Model No. 500 Cleaning and Rinse Gun adjusts for all unequal air and water pressures. 7. Completely portable.

Transmission Combines Features of Converter With Power Shifting

Borg-Warner Corporation's Warner Gear Div., has developed a heavy-duty industrial transmission for use on lift trucks, front-end loaders, and other materials handling equipment. They are designed for use with either gasoline or diesel engines.

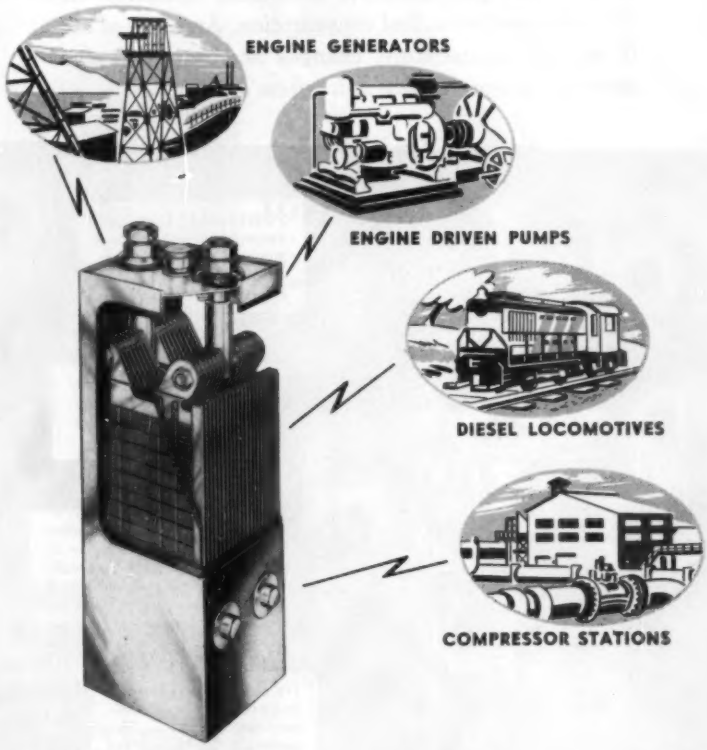
They are said to combine the most desirable features of torque converters and fluid couplings with the added advantages of power shifting in one or two speeds for forward and reversing operations. Heavy torque requirements, such as knifing under loads, starting on ramps, or towing and pushing, are obtained with torque converters driving through low- or high-speed transmission gears.

An operator can smoothly and accurately "inch" a lift truck into exact position and simultaneously maintain full engine power necessary to lift loads at top speed. This allows fast or slow movement with full positive control and full power.

POSITIVE STARTING

with NICAD

STORAGE BATTERIES



Outstanding records of dependability and economy have been achieved by NICAD batteries.

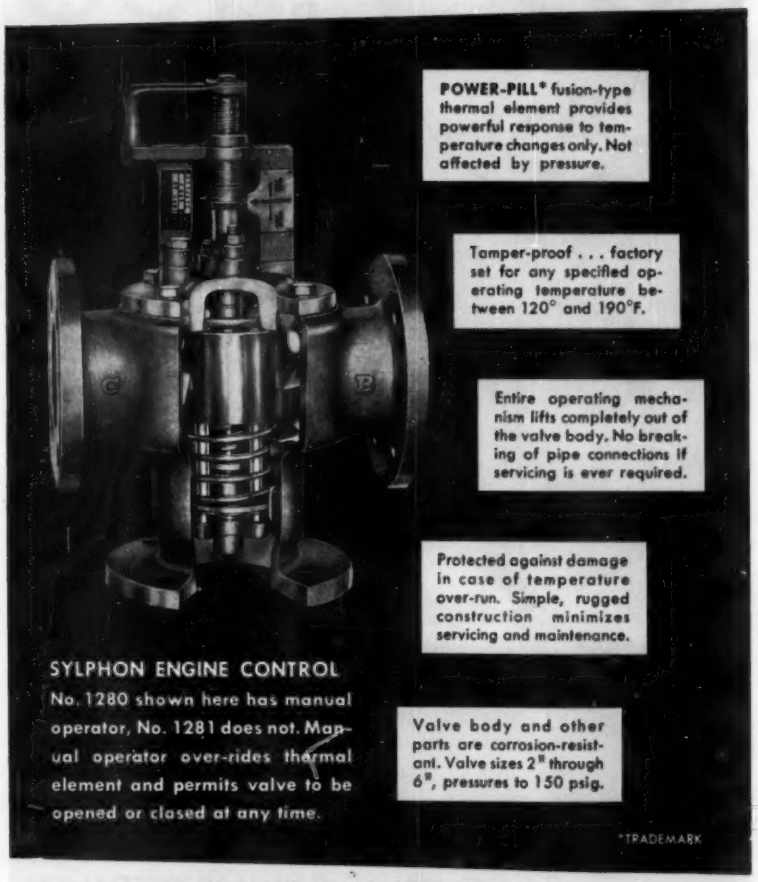
They perform perennially "like new" . . . provide instantaneous power . . . operate virtually maintenance-free under extremely adverse conditions . . . withstand high ambients . . . *never* give off corrosive fumes . . . have excellent voltage regulation . . . will not deteriorate during extended periods of idleness.

Ask us for complete information on NICAD engine starting batteries. *NICAD Division, Gould-National Batteries, Inc.,* Easthampton, Mass. Offices in New York, Chicago, San Francisco.

NICAD ALKALINE STORAGE BATTERIES

ALL-IN-ONE CONTROL FOR HIGHER ENGINE EFFICIENCY

By controlling cooling water or lubricating oil temperature, this Sylphon Engine Control guarantees the engine temperature you need for maximum operating efficiency—minimum fuel consumption. And best of all, it detects temperature changes and adjusts valve openings as *one complete unit—from one location.*



POWER-PILL* fusion-type thermal element provides powerful response to temperature changes only. Not affected by pressure.

Tamper-proof . . . factory set for any specified operating temperature between 120° and 190°F.

Entire operating mechanism lifts completely out of the valve body. No breaking of pipe connections if servicing is ever required.

Protected against damage in case of temperature over-run. Simple, rugged construction minimizes servicing and maintenance.

Valve body and other parts are corrosion-resistant. Valve sizes 2" through 6", pressures to 150 psig.

SYLPHON ENGINE CONTROL No. 1280 shown here has manual operator, No. 1281 does not. Manual operator over-rides thermal element and permits valve to be opened or closed at any time.

*TRADEMARK

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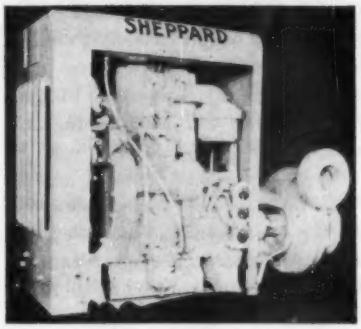
Robertshaw-Fulton CONTROLS COMPANY

Mr. Controls

FULTON SYLPHON DIVISION • Knoxville 1, Tennessee

new products



Polyamide Tubing For Fuel Lines Offer Big Savings

Polyamide or nylon tubing, known as Nylaflow pressure tubing, is used on fuel lines on Sheppard diesels ranging from 25 to 100 hp. Savings over other tubings have reportedly averaged $1.75 per engine. This specially processed product, made by The Polymer Corp., Reading, Pa., is said not to embrittle, weaken or crack under vibration and other conditions present in industrial, construction or agricultural installations.

No prebending or deburring is necessary when installing nylon tubing. Overbending is not a problem. Each length is positioned on the engine and coupled at each end with standard compression fittings. Vibration is dampened and absorbed in the tubing rather than transmitted to these fittings.

Kato Brushless A-C Generators

A complete line of 50-, 60-, and 400-cycle brushless a-c generators has been developed by the Kato Engineering Co.

These machines are available in both single and 3-phase output with all standard commercial voltages. The 60-cycle, 3-phase sizes extend from 5 to 400 kw and the 400-cycle from 1 to 250 kw.

All spark-producing components are replaced with a system of rectifiers which change a portion of the a-c output to direct current. This direct current is fed to the exciter field poles. The a-c output of the revolving-armature type exciter is in turn fed to a rectifier assembly and changed to direct current which is fed to the revolving-field poles of the alternator.

Engine Heater

In winter, a pre-warmed engine means: quicker starts; longer engine, battery, and starter life; lower maintenance costs; lower fuel consumption; lower storage costs (inside parking not necessary); and lower operating costs. An engine heater will do this for you.

A new type engine heater on the market, made by Tech Products, Inc., operates on the principle of an electric water heater.

The TPI unit consists of a 6-in long cylinder which contains a coiled heater element; an automatic bi-metal thermostat control; two outlet connections (one for receiving cold coolant from the system and the other for returning the heated coolant to the engine block); and a plug for connecting the unit to an electrical outlet.

The cold coolant is fed by gravity pressure from the engine cooling system to the heater. The heater element heats the coolant and expansion of the heated fluid causes it to flow through the heater outlet back into the engine. When the temperature of the return coolant reaches 130°F., the unit automatically shuts off and will not go on again until coolant temperature drops below 40°F.

Line of Flexidynes Expanded

An expanded line of Flexidyne dry fluid drives and couplings ranging in capacity from ¼ to 1000 hp, has been announced by Dodge Mfg. Corp. Added to the line are three larger sizes and a new small size for low horsepower applications.

The larger sizes include: an 18-in. diameter Flexidyne rated 200 hp at 1200 rpm, as a drive for use with v-belts, or as a coupling for direct shaft-to-shaft connection; the 22CK, rated 800 hp at 1200 rpm, as a coupling; and a 27-in. coupling, 27CK, rated up to 1000 hp at 900 rpm. These have proved effective on a wide variety of applications including conveyors, mixers, pumps, crushers, etc.

For medium light applications such as cranes, etc. a 6-in Flexidyne rated 200 hp at 1800 rpm is available as a coupling or for use with V-belt drives.

Diesel Fuel Filter

A new, small size, large area diesel filter is available from the Fuel Injection Div., Hartford Machine Screw Co.

The Roosa-Master fuel filter consists of a top, an element, and a base. The top contains an air vent screw and directions for venting, draining and changing.

The base contains inlet and outlet passages and a sump for collecting water and sediment.

The element is in a metal canister that serves as the body. It is a unique spiral paper construction providing maximum filter surface area within minimum dimensions. About 560 sq in. of filtering area are provided for low flow resistance.

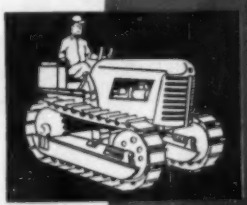
When the element becomes choked it is replaced without need of tools. Cost is less than that of replacing a throw-away filter assembly. Element is changed without disconnecting fuel lines.

lower initial cost
lower service cost

Compare and you will see the ROOSA MASTER fuel injection pump costs less. Use it and you will see that your service costs less. There are fewer parts to service and repair because of the unique design of ROOSA MASTER. It takes less space on your engine, and weighs less than 10 pounds. Even though small in size and light in weight one size serves either a 2, 3, 4, 6 or 8 cylinder engine.

HMS ROOSA MASTER makes good diesels better

HARTFORD MACHINE SCREW CO., HARTFORD 2, CONN.
DIVISION OF STANDARD SCREW COMPANY



The result of 17 years of engineering development is proven in hours and miles of outstanding performance.

Member

YOU CAN DEPEND ON THE DIESEL THAT DEPENDS ON ROOSA MASTER

people and plants

E. W. Robinson

White Diesel Appointments

Edward W. Robinson has been named branch manager of the Philadelphia region for the White Diesel Engine Div. of the White Motor Co. He replaces J. P. Hill, who is retiring.

Mr. Robinson is a familiar figure in east coast marine circles. He has serviced this area as vice president and manager of J. H. Mathis Co., as an applications engineer for a diesel manufacturer, and as a diesel engine salesman with another firm.

Edward H. Glascock has joined the White Diesel Engine Div. of the White Motor Co. as sales representative. He will be in the New Orleans region, which includes Louisiana, southern Arkansas, Mississippi, and Alabama.

Ted Gupton Moves To Pipe Line Technologists

Pipe Line Technologists, Inc. Houston, has appointed Ted Gupton management engineer. Mr. Gupton recently retired from Alco Products, Inc. as district sales mgr. in charge of Alco's Houston office. Prior to this, he was district mgr. in Kansas City for Alco's Diesel Div. covering the pipe line industry both nationwide and in Canada.

New DeLaval Industrial Sales Engineer

The De Laval Separator Co., Poughkeepsie, N. Y., has appointed Philip E. Mitchell industrial sales engineer. He will service Cleveland and surrounding industrial areas.

A newcomer to De Laval, Mr. Mitchell is thoroughly familiar with centrifugal equipment, having over sixteen years' experience in the centrifugal machinery field.

G. D. Hodgson

Enterprise Sales Engineer

Garrett D. Hodgson has been appointed a contract sales engineer for Enterprise Engine & Machinery Co., a subsidiary of General Metals Corp. Hodgson, previously employed as an industrial sales engineer for Johns-Manville, will work out of Enterprise's headquarters office in San Francisco.

Diesel piston before removing caked carbon and film.

The same piston after soak cleaning with LIX Diesel cleaner.

Maintenance costs running high?

KEEP YOUR DIESELS CLEAN AT LOWER COST with

LIX DIESEL CLEANERS

For cleaning **today's** diesels, you need a **modern** diesel cleaner. LIX Diesel Cleaners are so effective—so **sure**, so **fast** in action—that cleaning time is cut to the very minimum. Lix **soaks** away every bit of grease, grime and caked carbon from lube oil coolers, torque converters, etc.—you don't have to brush or scrape even the dirtiest parts. Lix Diesel Cleaners are **harmless** to all metals including aluminum and brass . . . **safer** (low in toxicity, and not a fire hazard) . . . and **last longer** without frequent charges.

Whatever your diesel cleaning job, there's a LIX Diesel Cleaner for it—**spray** or **soak tank types, electric equipment** cleaners . . . **NON-CHLORINATED.**

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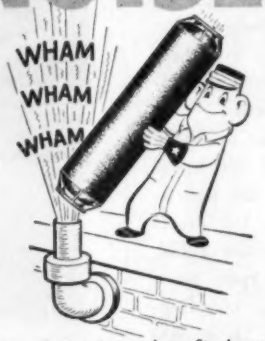

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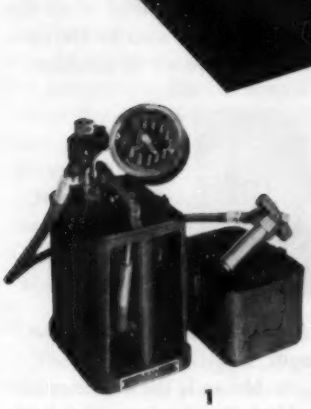
KIENE® diesel engine test equipment



1. Model KTP-50, Hydraulic Test Pump . . . designed for field service . . . portable . . . no bolts or clamps for leverage . . . many novel features.
2. Model K-120, Universal Indicator . . . for high-speed automotive type diesels...can be adapted to larger engines for firing pressure readings.
3. Model V-10, Indicator Valve . . . rugged . . . will not blow open . . . adaptions for all locomotives.
4. Model K-100, Cylinder Pressure Indicator . . . simple . . . accurate . . . for compression and firing pressures on large horsepower engines.
5. Model UTS-10, Portable, Universal Unit Injector Test Stand . . . checks all sizes in one fixture.

Kiene Adapters and Connectors available for all makes and models of diesel engines manufactured in U.S.A.

Kiene Diesel Engine Test Instruments are recognized throughout the industry for their accuracy and adaptability. They are designed for long service under most severe field conditions. Kiene equipment assures the proper maintenance of diesel engines . . . helps prevent costly down time. Get the facts on Kiene before you invest in diesel test equipment.

Send for Descriptive Literature

KIENE DIESEL ACCESSORIES, INC.
BOX 216, FRANKLIN PARK, ILLINOIS

T. J. Kiely

American Bosch Promotion

Thomas J. Kiely has been appointed manager of the Chicago Regional Sales Office of the American Bosch Div. of American Bosch Arma Corp.

Mr. Kiely joined American Bosch in 1921 and has served in various engineering and sales capacities. He went to the Chicago post from Cleveland where he was manager of the company's Regional Sales Office in that city. Previous to that, he had been attached to the Chicago Office for several years as a field engineer.

Exide Names Field Sales Manager

R. J. Muth, former Los Angeles branch sales manager for Exide Industrial Div. of The Electric Storage Battery Co., has been transferred to the Philadelphia headquarters as field sales manager. In the newly-created position under Exide's sales manager, he will be responsible for all branch operations in the U. S. This covers 16 regions with industrial battery sales and service facilities in 41 principal cities.

W. A. Penner

Worthington Denver District Mgr.

Walter A. Penner has been appointed manager of the Worthington Corp. Denver District Office. He replaces C. R. Walbridge who has resigned.

Mr. Penner joined the Worthington Buffalo Div. in 1938 where he served as a test engineer for two years. Subsequently he served in various engineering and engineering sales capacities at the corporation's Washington, D. C., San Francisco and Los Angeles district offices.

C. H. Sanders

C-B Southwest District Manager

C. Horace Sanders is now South-West district manager for the Cooper-Bessemer Corp., Mount Vernon, Ohio. He fills the post formerly held by A. A. Burrell, who is retiring after 33 years of active service with C-B.

Affiliated with C-B since 1927, Mr. Sanders served in the Company's Shreveport, Louisiana office before joining the Dallas office in 1931. He was promoted to assistant South-West district manager in 1946 and now moves into the top spot vacated by Mr. Burrell.

Vernatherm Products Manager

H. L. Walker is now product planning manager of the Vernatherm products of the Detroit Controls Div. of American-Standard, Detroit.

people and plants

(Continued from Page 73)

Forgings Firm Changes Name

The National Forge & Ordnance Company, Irvine, Pa., has changed its name. It is now National Forge Co.

The change was made to more accurately reflect its wide variety of industrial products. They produce crankshafts for diesel engines and gas compressors, molds for cast iron pipe, aircraft and missile parts, and heavy machinery components for more than 100 industries including mining, paper, cement, and steel.

Harrison Radiator Div. Field Service Representation Expanded

Harrison Radiator Div., G.M. Corp., Lockport, N. Y. has expanded and improved its field service representation throughout the U.S.

Their field service engineers are no longer based in the home office in Lockport and traveling between Lockport and various field service areas to which they are assigned. One is now assigned on a resident basis within his service area. This permits much closer contact with customers and makes it possible for field service problems to be solved more quickly and efficiently.

Because of this wide coverage, each field service engineer will be able to gather the broadest, most comprehensive information regarding performance and reliability of Harrison products in the field. The total of all this information will be used by Harrison to constantly improve its products.

C. E. Moore

New Mack Plainfield Plant Manager

Eugene Moore is the new manager of the Mack Trucks, Inc., Plainfield, N. J., plant. He will be responsible for all plant production operations and all mechanical services. The Plainfield factory is the manufacturing center for engines, axles, transmissions and other major components used in Mack's broad line of trucks, buses and fire apparatus.

Until his present appointment, Mr. Moore had been with the Crown Enclosure Div. of Crown Cork Seal Co., in Baltimore, as manager of manufacturing.

Flexonics Marketing VP

Edward A. Malling has been appointed vice president of marketing at Flexonics Corp. To accept this position, he resigned as manager of marketing for the Specialty Electronics Components Dept. of General Electric.

His new job was created as part of the new organization plan which Flexonics has been putting into effect during 1958. In this position, Mr. Malling will be responsible for Flexonic's complete marketing program.

New Sinclair Research Lab.

Sinclair Research Laboratories, Inc., a subsidiary of Sinclair Oil Corp. has established a research office in Detroit. Its purpose is to maintain a closer research liaison with the automotive industry.

Walter G. Ainsley will be in charge of the new office. His function will be coordinator in research between Sinclair and the automotive industry.

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Joseph Lucas (Canada) Ltd., Head Office: 11 Davies Avenue, Toronto 8, Ontario
Branch Office: 3401 St. Antoine Street, Montreal 30, Quebec

AP819

Oakite Appoints Technical Director

Dr. Clarence Bremer, formerly director of research, has been appointed technical director of Oakite Products, Inc. He will be responsible for the company's research and product development, and technical service laboratories. He has been a member of the company's board of directors since 1956, and with Oakite since 1942.

Dr. Hugh Hodge is Oakite's research laboratory manager and Charles Rack is head of the technical service laboratory.

Cummins Plans Plant Expansion

The Cummins Engine Co., Inc., Columbus, Ind., plans the construction of a major addition to its manufacturing plant. Construction is to start late in 1958. The new facilities, costing over $6 million, including equipment, will provide about 300,000 sq ft of additional floor space, an increase of 38%. It will be the largest single building on present site.

It will include new engine test cells, additional space for the assembly of marine engines, diesel-electric generating sets, power units, and adequate export boxing areas and shipping docks. The new facilities will also include an additional power house.

Allison Expands Sales Organization

The Allison Div. of GM has launched a major selling drive for fully-automatic transmissions on medium and heavy highway trucks. The expanded sales organization is headed by J. K. Knighton. He has been appointed assistant sales manager for highway transmissions.

The expanded program contains three major parts:

1. Expansion in the selling organization to increase selling contact with truck companies, etc.

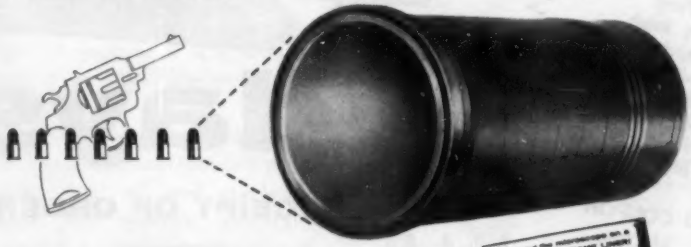
2. An increased advertising program in leading business and fleet trade publications.

3. A series of spring and fall direct mailings to 50,000 fleet operators who are potential users of automatic transmissions.

MECROME LINER POROSITY

as uniform as the rifling of bullets from the same gun!

The distribution of pockets that retain the lubricating oil on the bearing surfaces of Mecrome liners is as uniform as the rifling of bullets fired from the same gun! This means "break in" periods are rapid. The bearing surface has no large solid unetched areas that cause friction where the liners contact the rings. This even distribution of pockets also results in long liner life as there are no large soft spots that wear out prematurely. Keep diesels in service longer. Send us a trial order today.



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Opposite port pump. Custom built.
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If you are a manufacturer of machines requiring pumps, it will pay you to learn how a Viking rotary pump could add quality, as an integral part of your equipment. The standardization of Viking Pumps on so many pieces of equipment in the industrial field proves their successful performance.

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Feed mixers	LP-Gas fuelers
Marine gear sets	Fuel delivery trucks
Dry cleaning equipment	and many others . . .
Milk trucks	

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Cedar Falls, Iowa

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See our catalog in Sweets Industrial Construction and Plant Engineer's File.

new literature

Alco Model 251 Engine

Two bulletins released by Alco Products, Inc. deal with their Model 251 engine. One covers the engine thoroughly, detailing its specific features and applications. Photos illustrate all major engine components. Diagrams and tables give dimensions and complete engine specifications. Modifications of the Model 251 for marine, dual-fuel and spark-ignition services are also discussed.

The other bulletin deals specifically with application of this engine to on-shore and off-shore oil well drilling.

Heat Exchanger Bulletins

Advances in heat exchanger design have been made by engineers of the Yates-American Machine Co. of Beloit, Wisc. Two new lines of heat exchangers have been introduced. What these advances mean to you are discussed in two bulletins.

Bulletin HT-20 gives standard dimensions, materials, and engineering data on their new steam fixed-bundle models.

Bulletin HT-21 gives data on their new stainless steel fixed-bundle heat exchangers which are said to give resistance to corrosion plus high strength and high thermal efficiency.

Blackmer's New Pumps Described

Revised Bulletin 200 by the Blackmer Pump Co. provides up-to-date information on their expanded line of rotary truck pumps. The complete range of Blackmer pumps with capacities from 25 to 725 gpm at up to 100 psi is covered.

Another Blackmer bulletin describes a new line of gear-head rotary pumps with a new helical gear reducer. Detailed in this Bulletin 110, are three series, the GX, GXS and GXU, pumps for handling petroleum products.

Three basic styles of heavy-duty rotary pumps are described in Bulletin 170. These include: the HNL, with internal anti-friction bearings; the HXL, with external anti-friction bearings; and the HNLJ, which is equipped with jacketed heads for steam circulation when handling extremely viscous liquids.

A-C "Super-Seal" Open-Type Motors

"Super-Seal" open-type motors suitable for many applications previously requiring enclosed designs are described in a new Allis-Chalmers bulletin. Available in all integral horsepower frames, the motors are unaffected by moisture, dust, dirt, oils, acids, and alkalies.

In addition to lower cost as compared to totally-enclosed, fan-cooled designs, "Super-Seal" motors have a 1.15 service factor which frequently permits using a smaller motor size. An example of how the motor saves 30% on a typical pump drive is given in the bulletin.

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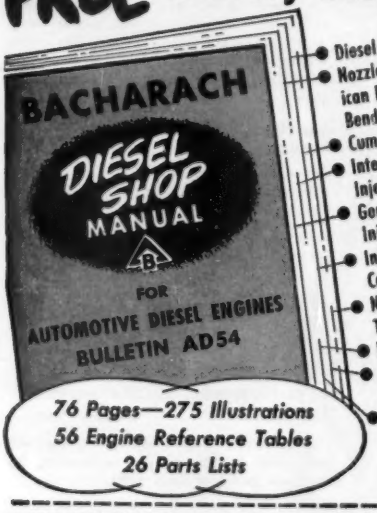

- Diesel Compression Testers
- Nozzle Testers for American Bosch, Caterpillar and Bendix Nozzles
- Cummins Injector Tester
- International Harvester Injection Testers
- General Motors Injector Testers
- Injection Pump Calibrating Stands
- Nozzle-Injector Cleaning Tools and Lapping Blocks
- Engine Overhaul Stands
- Engine Removal and Parts Dollies
- GM 71 Engine Tools

76 Pages—275 Illustrations
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26 Parts Lists

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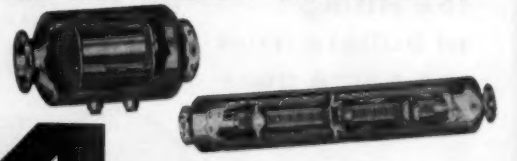

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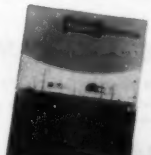

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1958 Diesel Standard Practices

The 1958 Standard Practices for low and medium-speed stationery diesel and gas engines published by the Diesel Engine Manufacturers Association is now off the press.

This 220-page, 20-chapter, fifth edition of the DEMA Standard Practices is prepared specifically for consulting engineers, diesel plant superintendents and operators.

Standard Practices is the work of an outstanding committee of engineers whose every-day work in the factory and in the field qualifies them to write authoritatively on diesel engine construction, rating, selection, installation, fueling, lubrication, cooling, performance and operation.

Essentially all changes recommended by such groups as NEMA, AIEE, oil companies, etc. have been incorporated. In view of the purposes for which the book is written, neither style or format were changed.

Some highlights of this edition include up-to-date data on: high output superchargers and turbochargers; intake air cooling equipment; speed governing of internal combustion engine-generator units; lube oil characteristics; heating and cleaning of residual fuel oils; gaseous fuels; generator and electrical equipment; and selection of engine sizes.

Kent-Moore Diesel Diagnosis Kits

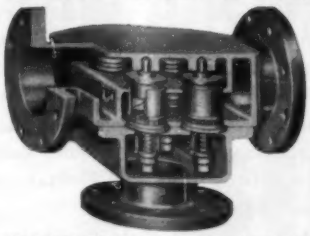
A new diesel diagnosis test kit is described in a bulletin by Kent-Moore Organization, Inc.

The Model J7333 kit is for use with the GM Detroit Diesel Series 51, 71 and 110 engines. It is a modern revision of the J4209 kits previously available.

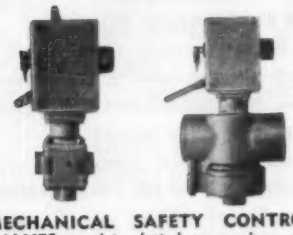
Instrumentation is provided for checking: timing; exhaust back pressure; air box, oil, and crankcase pressures; liner position; etc. Suitable hose and bushings are included for connecting to slack-tube manometers and pressure gauges included in this kit.

Speed can be checked with the J7127 kit, included in the J7333 kit. This consists of a precision tachometer with all the drive adapters required for checking engine and accessory rpm.

AMOT ENGINE CONTROLS

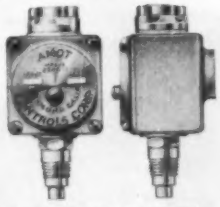


THERMOSTATIC VALVES, for jacket water and lube oil temperature control. Self contained, modulating, use no external bulbs. Sizes 1½" to 6". Temperature settings 75°F to 195°F.



MECHANICAL SAFETY CONTROL VALVES, used to shut down engines and compressors in event of oil pressure failure, overspeed, overheating of jacket water or lube oil, etc.

VENTED GAS VALVE, diaphragm operated will shut off the fuel gas and vent the manifold when used on internal combustion engine applications. Made in 2", 3" and 4" sizes.



SAFETY CONTROL SWITCH will flash warning signal, sound an alarm or close a solenoid fuel valve on overheating of jacket water or lube oil, or pressure failure of lubricating system.

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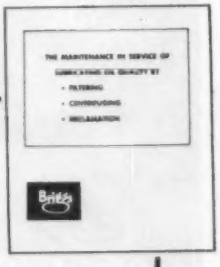

SERVICE, MAINTENANCE AND PERIODS OF OVERHAUL ARE DIRECTLY RELATED TO OIL QUALITY.

This booklet is an authoritative survey of factors that have direct bearing upon the difference between economical oil protection and maintenance . . and costly, less practical methods that spell increased engine down-time. Subjects covered are "Lube Oil Function" . . "Contamination Sources" . . "Methods Used to Test for and Correct Conditions That Contribute to Higher Operation Costs." Easy to read, short and contains all the data that can be applied in daily maintenance and service. Write for your copy now.

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new literature

(Continued from Page 77)

Speed Measurements Must Be Accurate

If it is important that a test or measurement provide reliable information you must select the proper instrument for the test.

James G. Biddle Company's copy of Bulletin 35 covers a wide variety of hand and fixed-types of speed-measuring instruments. Both electrical and mechanical type tachometers are illustrated and described. Application, selection and operation, data is given for each Model instrument available.

Dynamometer Training Films

The Dynamometer Div. of Clayton Mfg. Co. has completed two training films on the use of chassis dynamometers. These 35-mm, sound-strip films cover engine analysis, transmission and drive line trouble shooting as well as the efficiency of chassis dynamometers for fast quality control tests. These films are available on a loan basis.

Hydrotor Hydraulic Cranking Systems

A 14-page, illustrated bulletin, entitled, "From Arctic To Tropics-Hydrotor Hydraulic Cranking Systems" by the American Bosch Div., American Bosch Arma Corp., covers the following relative to the Hydrotor: what it is; how it operates; basic systems; cranking systems comparison; typical system diagrams; how to order; cranking motor specs; system components; how it is installed; and gives details of the Hydrotor on the job.

Directory For Truckers

A 28-page booklet for truckers, listing authorized GM diesel service outlets in the U.S. and Canada, has been released by the Detroit Diesel Engine Div. of G.M.

Entitled "Pocket Directory of GM Diesel Service Outlets", the booklet is a handy glove-compartment item of specific use to "Jimmy"-powered truck owners and operators. A special illustrated section covering design features of the GM Division's truck engine line is also included.

Gould Pumps

Bulletin 721.6 describing its line of single-stage, double-suction centrifugal pumps with horizontally-split cases has been issued by Goulds Pumps, Inc.

This 16-page bulletin includes a general description of Fig 3405 and Fig 3406 pumps. Specifications, sectional views, charts showing materials of construction, parts list, and parts interchangeability, construction details, mechanical data, performance curves and dimensional data are also given.

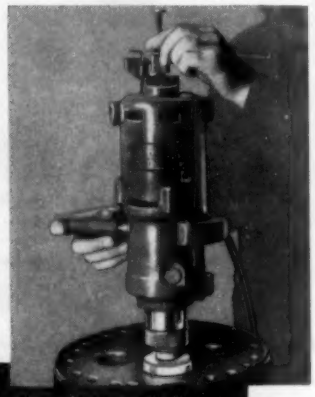
New Standards of Expansion Joint Manufacturers Association

The first edition of Standards of Expansion Joint Manufacturers Association has just been published.

This edition contains up-to-date information concerning the design, construction, application and testing of expansion joints for piping and other services. Much of this information has never been published in any text or reference book. For this reason it will be of real value to the thousands of manufacturers, contractors, engineers and Government officials who specify and purchase expansion joints.

The format of the first edition is 8½-in. x 11-in. with semi-flexible simulated leather cover and costs $1.00 postpaid.

NOTHING EQUALS THE ECCENTRIC METHOD OF VALVE SEAT GRINDING EXCLUSIVE WITH HALL TOLEDO



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Only Hall-Toledo's EDP Valve Seat Grinder can absolutely assure the finest performance results by providing perfect valve seating.

Whether you do your own valve work or have a diesel engine service organization handle it, be certain that HALL-TOLEDO equipment is used for faster, factory approved precision valve seat grinding. The MODEL EDP, especially designed for heavy duty diesel engines, will handle grinding wheels from 2" to 7" diameter. The Model EJ HALL-TOLEDO VALVE SEAT GRINDER is also available to precision grind smaller valve seats.

Write today *for information on the complete Hall-Toledo line for factory production or engine rebuilding work.*

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A-C Portable Diesel Generator Set

Highlights of design, engineering and construction features of the recently introduced Allis-Chalmers G-226 portable, lightweight diesel-driven generator set are covered in a new catalog, BU-412. It is available from the Engine-Material Handling Div., Allis-Chalmers Mfg. Co.

Included are sketches showing in-use application of the unit, engine cutaways, and photographs of numerous important components. Specifications of the basic generator set are also included.

Fact File on Hard-Surfacing

A hard-surfacing fact file is being offered by the Metal & Thermit Corp. For construction equipment shops and others facing hard-surfacing problems daily, it gives helpful data on the Murex R line of 88 types and sizes of Hardex hard-surfacing electrodes and rods. Complete data for reference files is listed on convenient 3-in. x 5-in. cards which provide finger tip access to this information.

Improved Fixed-Bundle Heat Exchanger

The increasing demand for standard stock, high-performance shell-and-tube heat exchangers has led to the development of a new line of fixed-tube bundle multi-purpose units by the Perfex Corp.

Catalog No. 5801-X covers these units in detail giving complete dimensions for all models. It explains how these units can help you solve your heat transfer problems and highlights the latest design advances that made this possible.

Kato High-Voltage Generators

Kato's 50 and 60-cycle alternators are adaptable to any engine with a standard SAE bell housing. Kato Engineering Co. makes a complete line of flexible couplings and bell housing adaptors. These are supplied with their alternators and machining and drilling finished to customer specifications.

Bulletin HV 558 illustrates and describes these alternators, accessories and controls in detail. It also gives ratings of all the units available between 60 kw and 400 kw.

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EXHAUST VIBRATION
PIPE EXPANSION
FLANGE MISALIGNMENT
ENGINE PULSATIONS
OFFSET MOTION
OIL LINES
AIR INTAKE

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This new fact-filled brochure gives latest Engineering Data on *corrugated steel* and *stainless steel Diesel exhaust* and *air intake lines* . . . installation diagrams and tables plus analyses of Diesel engine pipeline problems . . . how Allied's 10-X and 21-X overcome vibration, expansion and contraction, misalignment, engine pulsations, offset.

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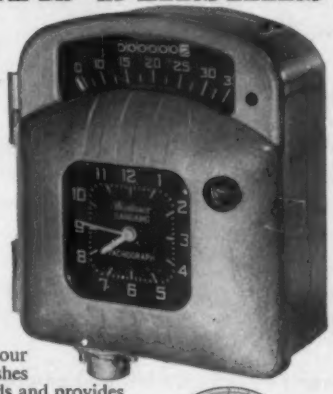
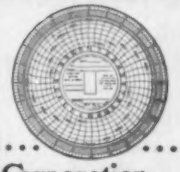
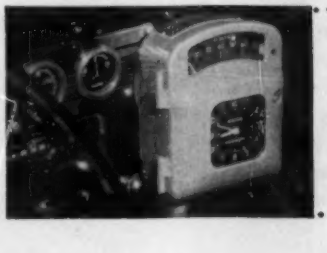


The Wagner-Sangamo RPM Tachograph keeps your drivers posted on engine speed at all times—flashes a warning signal to warn of excessive engine speeds and provides supervisors with an accurate charted record to check operator performance. Model BB Tachographs are available for 12 or 24 hour records and for 2500 or 3500 RPM maximum engine speeds. Find out NOW how a small investment in a Tachograph for every diesel you operate can pay big dividends by encouraging safer, more economical driving. Mail the coupon below.





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GRIND CRANKSHAFTS IN THE BLOCK!
The Winona Istblok Crankshaft Grinder has given fast, accurate service in the Automotive field for over 18 years. Now it's available to the Diesel field. With a new large hook, the standard grinder will now grind shafts up to 3½" in diameter in the block!
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new literature

Allis-Chalmers Catalogs

Three new Allis-Chalmers catalogs give information on their diesel-powered harvesting equipment.

Catalog #TL-1906 describes the No. 7 drive. Catalog No. TL-1905 covers the new A-C forage harvester and forage and grain blower. Catalog No. TL-1911 describes and gives specifications on the Model 90 All-Crop harvester.

Silver Power Injection Equipment

Silver Power of Los Angeles, Calif., offers replacement fuel injectors for Cummins diesels on an exchange basis.

A series of parts sheets illustrate and describe the injectors and explain how they're modified for better performance. Part number, orifice sizes, quantity per engine, etc. are listed for the proper injector for all Cummins engine models. Instructions are given on how to order them.

Oil Condition Indicators

Guesswork is removed when you use Gerin's oil condition indicator to determine if your lube oil needs to be changed. A bulletin by The Gerin Corp. explains how you can tell at a glance the viscosity condition of lube oil.

The bulletin tells how the use of a meter protects the engine by warning you promptly, when due to dilution or other causes, lube oil viscosity has changed to such a degree that it is no longer safe to keep the oil in the engine.

Plastic Steel Described

Plastic steel and other products for metal working, and other industries are described in Devcon Corporation's latest catalog NI-103. A complete coverage of the chemical and physical properties of these products is made. The catalog also contains illustrated case history type applications of plastic steel; Devcon C, the heat-resistant type; Devcon F, The aluminum putty; and Devcon WR, the wear-resistant type.

Air-Operated Governor Test Stand

Hill Machine Company's air-operated governor test stand is used for checking Woodward type SG, SGX, PSG and PM hydraulic governors. A bulletin published by Hill shows and describes the test stand, lists its accessories, tells how it works and explains how it is used.

A-C's D Series Utility Tractor Line

A pictorial review of the Allis-Chalmers D-Series utility tractor line introduced recently by the Tractor Group, is given in catalog, UT-103. Photos showing various attachments for the D-Series in action tell the versatility story of the tractor line.

Engineering, design and construction features that combine with companion equipment to provide high power and performance are pictured. Also included are specifications and dimensions of the D-14 and D-17 tractors.

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new products

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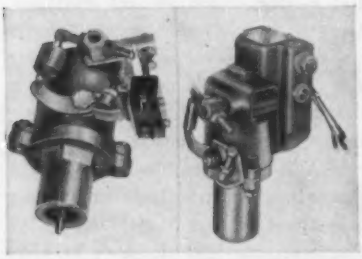


Centrifugal-Switch Governor

The Pierce Governor Co. Inc., Anderson, Ind. has put a new series of centrifugal switch governors on the market. They're for use as overspeed protection or for any switch sequencing operation involving the operation of single or multiple circuits relative to speed.

Its compact design minimizes interference problems. Simplified mounting permits quick installation on any 7/8-18 tachometer outlet. This reduces installation time and costs.

Diaphragm-Operated Gas Valve

The line of model 2180 diaphragm-operated gas valves recently introduced by the Amot Controls Corp., for use on gas engines, can also be used as a remote-operated valves for starting air on both gas and diesel engines. Their pressure range is from 20 psi to 300 psi.

The valves feature: compact design; no need for adjustments; sealed diaphragm operation; stems enclosed away from dirt; tight seating; large vent port; O-ring stem seal; and rectangular rubber valve seats.

Dual Operator Sandblast Machine

For use on large scale jobs, two sandblasters may now blast from one pot. The latest Clemco continuous action machine, Model CA 2460, is equipped with two blast hoses working off two sand control valves. These machines are double-chamber types holding 1000 lbs of sand with automatic pop-up filling valves and 1¼-in piping.

All blasting is done from the bottom chamber which permits refilling of the upper chamber without interrupting the sandblasting. The abrasive in the upper chamber automatically transfers to the lower chamber.

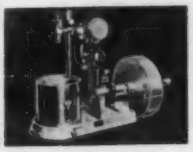
Portable Hydraulic Motor Pump

Tal Bending Equipment, Inc., has developed a 10,000 psi heavy-duty, portable hydraulic motor pump weighing only 65 lb.

It can be used for pressing, pushing or pulling bushings, bearings, shafts, pump pistons, arbor presses, lifting operations and pre-stressing of conduit. Also for any hydraulic repair tools in the shop, pressing small ceramics and powdered metal parts and wherever hydraulic power is used or can be used to replace mechanical power.

According to E. G. Ewell, vice president-sales, the new vehicle will be the first cab-forward type with set-back front axle capable of accommodating a diesel engine over 200 horsepower.

Mack gasoline engines of 150 and 185-hp and Mack Thermodyne diesels of 170 and 205-hp are used.



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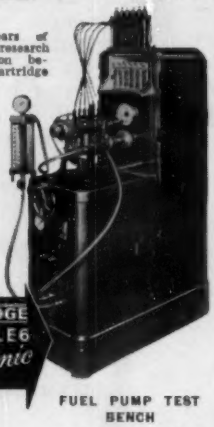

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industry news

(*Continued from Page* 65)

Turbo-Tug Tows Jet Aircraft

Use of conventional tractors has become impractical for large jet aircraft. This is because of the weight of the vehicle required, tow-bar loads, the low silhouettes of the newer planes, and the difficulty of maneuvering aircraft by tow bar.

Turbo-tug, a lightweight, low-silhouette, gas turbine-powered vehicle overcomes these difficulties. Now in the prototype stage, it is nearly ready for commercial production by Napco Industries, Inc. Minneapolis, Minn.

The 47-in high, 9000 lb unit slips directly under the aircraft and is attached to the main landing gear axle. Once coupled to the landing gear it becomes an integral part of the aircraft and is controlled by the pilot.

The Turbo-Tug is powered by a Boeing Model 502-10C, 270-hp gas turbine weighing 320 lbs.

National Power Show

More than 200 manufacturers of power and allied equipment have contracted for space in the 23rd National Exposition of Power and Mechanical Engineering. The exposition will be held at the New York Coliseum, next December 1 to 5. The display will be staged under the auspices of The American Society of Mechanical Engineers, whose 78th Annual Meeting occurs concurrently.

Hamilton Engine Sales

Diesels for a wide variety of applications are being sold by Hamilton Engine Sales, Inc. of Portland, Oregon. For example, recent deliveries in the Oregon territory include: one 300-kw Allis-Chalmers generator set, trailer-mounted, with 100-hp electric motor for crushing operations; one Allis-Chalmers model 6DAS-844 power unit with a Rockford clutch; one Allis-Chalmers Model DAMR-273 diesel engine with Capitol 2:1 hydraulic marine gear for repowering a fishing boat; one Allis-Chalmers Model 4DA-182, and one model 2BD-77 diesel pumping units; and one trailer-mounted 5-kw air-cooled American Marc generator set for emergency and standby lighting on a construction job.

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industry news

(*Continued from Page 84*)

Curtiss-Wright Gets Large Order For Earthmoving Equipment

Delivery of the first five units of a $500,000 order for earthmoving equipment for major highway construction has been made by Curtiss-Wright Corp. The order was placed by the Madonna Construction Co., of San Luis Obispo, Calif. It covers a fleet of nine self-propelled scrapers, each of 20-cu yd struck capacity.

The South Bend Div. of Curtiss-Wright is producing and marketing a complete line of self-propelled and tractor-drawn scrapers and related earthmoving equipment under the name of Curtiss-Wright Construction Machinery.

Delivery of the units is being made through Smith Booth Usher Co., Los Angeles, A C-W distributor.

Ford Industrial Tractors

A new line of Ford diesel-driven industrial tractors and matching high-capacity loading and digging equipment has been developed by the Tractor and Implement Div. of Ford Motor Co. A separate industrial franchise will be available to new and existing dealers.

Details of the equipment will not be made public until dealers can be supplied. However, the new tractors are already on the production line at Ford's Highland Park, Mich., Tractor Plant and new equipment for use with them is going into production at its Des Moines (Iowa) Implement Plant.

Because purely industrial equipment requires different types of service facilities, parts stocks, and trained manpower from farm equipment, the Division is putting into effect, through its distributors, a new industrial sales agreement.

Industrial dealers will be located at strategic points across the U.S., Canada, Cuba, Mexico, and the Hawaiian Islands.

Rock Island To Test Run Aerotrains

The Rock Island Lines is test running the first of two improved Electro-Motive Div.-built Aerotrains in their suburban service. The tests may result in ultimate purchase of the two virtually new lightweight trains.

Each Aerotrain has 10 air-conditioned coaches and is powered by a 1200-hp diesel locomotive.

Iran Shah Given M-M Diesel Tractor

J. R. Duncan president of Minneapolis-Moline gave the Shah of Iran the largest tractor made by M-M. The tractor was given to the Shah during his visit at the M-M plant. The Model GB diesel unit is to be delivered to the Shah in Teheran. This gift was made in acknowledgement of the Shah's vital interest in farming and was presented in the name of the Board of Directors of the firm and also in the name of the firm's distributor in Iran, Sabet-Pasal Co.

Teacher Summer Workshop

This summer, 580 teachers of automotive courses in high and vocational schools received instruction in latest automotive advancements in classes conducted in General Motors Training Centers throughout the country.

A total of 79 weekly programs covering 27 subjects was completed in 14 of the 30 training centers. Subjects included diesels, air suspension, fuel injection, and many others.

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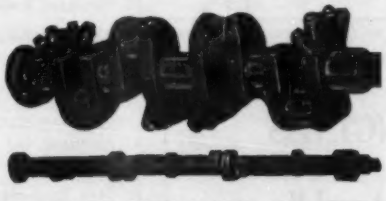

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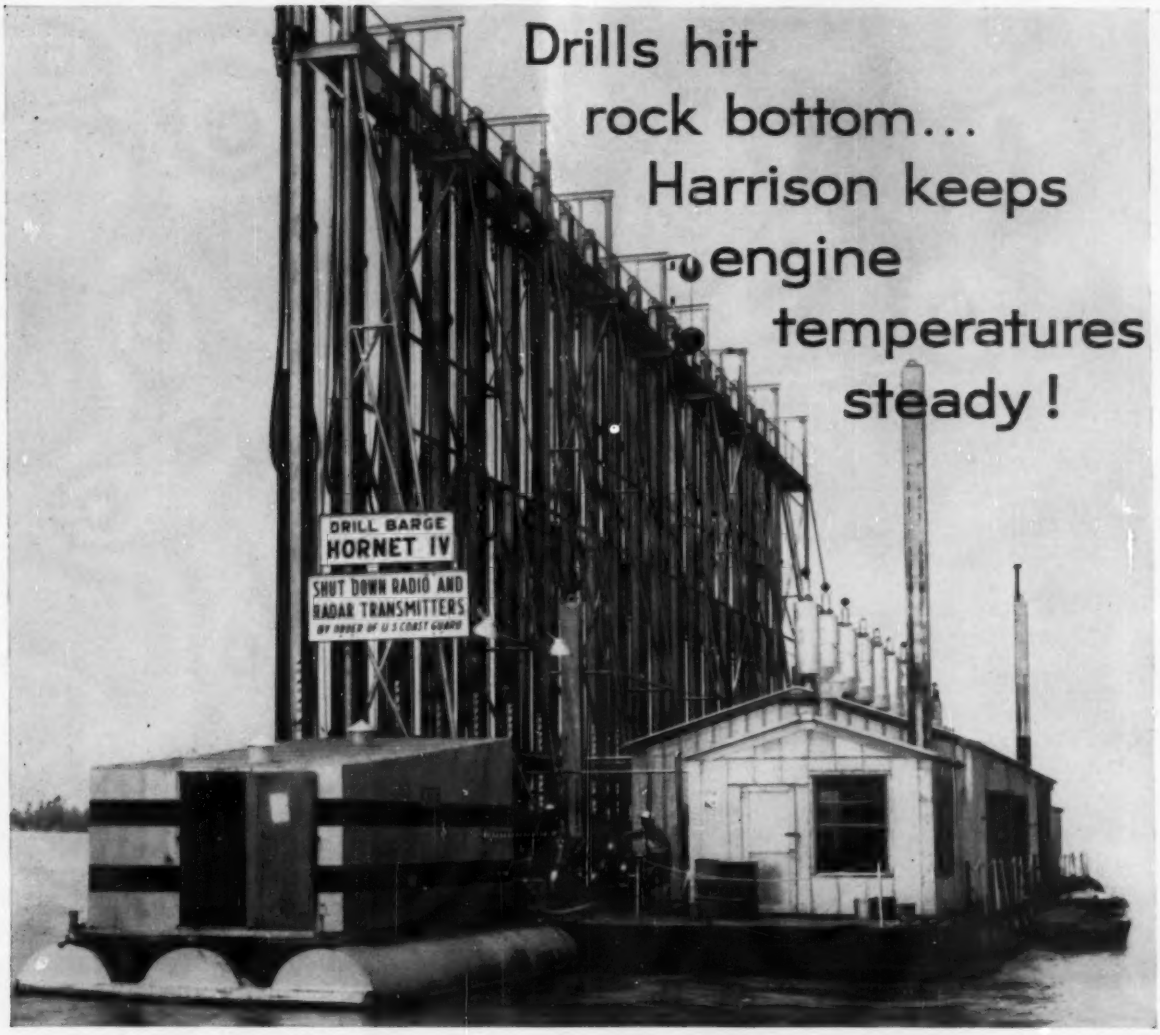

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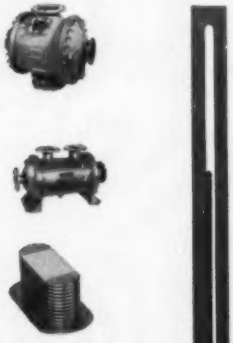

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